DOCUMENT RESUME

ED 275 332 IR 051 680

AUTHOR	Dollar, Charles M.
TITLE	Electronic Records Management and Archives in International Organizations: A RAMP Study with Guidelines.
INSTITUTION	United Nations Educational, Scientific and Cultural Organization, Paris (France). General Information Programme.
REPORT NO	PGI-86/WS/12
PUB DATE	Jan 86
NOTE	174p.; For an earlier RAMP study on records management in international organizations, see ED 262 779.
AVAILABLE FROM	Division of the General Information Programme, Documentation Centre, UNESCO, 7 Place de Fontenoy 75700 Paris, France.
PUB TYPE	Guides - Non-Classroom Use (055) -- Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Archives; Artificial Intelligence; Automation; Computer Software; Electronic Mail; Evaluation Criteria; Guidelines; *Information Storage; *Information Technology; *International Organizations; Optical Disks; Questionnaires; Technological Advancement
IDENTIFIERS	General Information Programme; Office Automation; *Records Management; UNESCO; UNISIST

ABSTRACT

This study is a review of trends in information-handling technology and significant developments which are changing or will change the general environment within which archivists and records managers in international organizations will have to work. Trends in microelectronics, electronic storage, software, data transmission, computer architecture, data entry, and non-digital storage are discussed; electronic technology applications including office automation, electronic mail, data exchange standards, optical disks, computer-assisted retrieval of microfilm, text conversion, and artificial intelligence or expert systems are presented; and the implications and opportunities for new technologies are considered. A discussion of the survey of international organizations conducted to collect information on electronic records management and archives is also presented, and recommendations and guidelines for the Section of Archives of International Organizations (SIO) and for archivists and records managers are offered. Appendices include a glossary, end user hardware/software evaluation criteria, a copy of the questionnaire used in the survey, and lists of sources. (KM)

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United Nations Educational,
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Paris, 1986

IR051680

Original: English
PGI-86/WS/12
Paris, January 1986

ELECTRONIC RECORDS MANAGEMENT AND ARCHIVES IN INTERNATIONAL ORGANIZATIONS: A RAMP STUDY WITH GUIDELINES

prepared by

Charles M. Dollar

General Information Programme and UNISIST
United Nations Education, Scientific and
Cultural Organization

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Recommended catalogue entry :

Dollar, Charles M.

Electronic records management and archives in international
organizations: a RAMP study with guidelines /
prepared by Charles M. Dollar / for the / General Information
Programme and UNISIST. - Paris: Unesco, 1986. - 159 p.;
30 cm. - (PGI-86/WS/12)

I - Title

II - Unesco, General Information Programme and UNISIST

III - Records and Archives Management Programme (RAMP)

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PREFACE

In order to assist in meeting the needs of Member States, particularly developing countries, in the specialized areas of archives administration and records management, the Division of the General Information Programme has developed a long-term Records and Archives Management Programme - RAMP

The basic elements of RAMP reflect and contribute to the overall themes of the General Information Programme. RAMP thus includes projects, studies and other activities intended to :

- develop standards, rules, methods and other normative tools for the processing and transfer of specialized information and the creation of compatible information systems;
- enable developing countries to set up their own data bases and to have access to those now in existence throughout the world, so as to increase the exchange and flow of information through the application of modern technologies;
- promote the development of specialized regional information networks;
- contribute to the harmonious development of compatible international information services and systems;
- set up national information systems and improve the various components of these systems;
- formulate development policies and plans in this field;
- train information specialists and users and develop the national and regional potential for education and training in the information sciences, library science and archives administration.

This study is a review of trends in information-handling technology and significant developments which are changing or will change the general environment within which archivists and records managers in international organizations will have to work. It is also a review of a number of pilot research projects and operational programmes which are underway. It provides recommendations for action at different levels and includes a glossary, a selective bibliography and a detailed questionnaire for identifying problems in using information technology for records management and archives in international organizations. It is hoped that this study with the guidelines will give specialists the possibility to better understand the situation and will help them to deal with the difficulties and find appropriate solutions.

Comments and suggestions regarding this study are welcomed and should be addressed to the Division of the General Information Programme, UNESCO, 7 Place de Fontenoy, 75007 Paris. Other studies prepared under the RAMP programme may also be obtained at the same address.

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ACKNOWLEDGEMENTS

Although this study draws upon my own experience and knowledge about new information handling technologies and their impact upon records management and archives, a number of people made my task much easier. Ms. Gertrude Long, Chairman of the Section of Archivists of International Organizations (SIO) of the International Council on Archives and Archivist of the International Monetary Fund in Washington, D.C., was very generous with her time in reviewing with me some of the trends and developments in interational organizations. In addition, she and Dr. Frank B. Evans of the National Archives and Records Administration, read the study in draft form and called my attention to errors and misinterpretations. I am indebted to Dr. Thomes E. Brown of the National Archives and Records Administration for his invaluable assistance in helping design the questionnaire, preparing a preliminary analysis of the survey data, and reading the study in draft form. My colleague on the Archival Research and Evaluation Staff, Mr. William Hooton, prepared the illustrations used in chapter one and read the manuscript with an eye for technical inaccuracies.

Other people who contributed to the study were those archivists and records managers who responded to the questionnaire as well as the individuals who permitted me to interview them. In addition, attendees at the 1985 SIO Annual Meeting in Paris, France reviewed the manuscript and offered helpful suggestions. The assistance of Stan J. Cieniewicz, Registrar at the United Nations Disaster Relief Organization, in Geneva made my work there much easier and my visit very pleasant.

The assistance of all of these people greatly strengthend the study. Nevertheless, any error of fact or misinterpretation remains the responsibility of the author.

Charles M.Dollar

INTRODUCTION

0.1 The key concept in this study is that an understanding of the implications of electronic technology for archivists and records managers in international organizations involves both an examination of the technology itself and the environment in which that technology will function. The implications of electronic technology, or what is defined as the supply side, includes the technology of computers, software, communications, information sevices, databases, printers, and memory devices, among others. Certainly this aspect requires major attention, since technological capabilities help structure what can be accomplished. The demand side of information technology is the organizational environment - individual productivity enhancement, centralization versus decentralization of management, organizational structure of institutions operating in a network, and the like.

0.2 This demand side of information technology has serious long range implications for archivists and records managers in international organizations, in that it may increase the distance that separates them from the information for which they are responsible. This distancing may include information technology decisionmaking which can have a profound, though indirect, impact upon archival and record management programs. For example, a decision to install a new telecommunications capability, which includes an electronic mail and message system, introduces a new set of archival and records management concerns which may not be apparent to the decisionmakers. Not having a voice in information technology decisionmaking inevitably means that archivists and records managers are likely to have very little influence in the shaping of information technology policy.

0.3 This rather bleak picture in which archivists and records managers in international orgnizations (as well as in other organizations) may find themselves in an environment where they are the passive recipients of information derived from processes over which they have little influence or control need not be the scenario of the future. Indeed, this study along with its recommendations is premised on the expectation that archivists and records managers in international organizations can (and should) become involved in the shaping of information technology policy and decisionmaking.

0.4 The first chapter of this study focuses upon a detailed examination of information technology as it relates to trends in microelectronics, software, storage, data transmission, new computer architecture, text conversion, and computer-based micrographics systems. Chapter two elaborates on some of these trends, with a review of a number of pilot research projects or operational programs now underway. These trends and applications provide the context in which general records management and archives policies, principles, and practices are reviewed in chapter three. This chapter concludes with the identification of key opportunity areas which information technology presents to archivists and records managers.

0.5 Contemporary archival and records management policy and practice in international organizations is the theme of chapter four. A detailed questionnaire on archival and records management policy and practice was sent to 34 archivists and/or records managers in international organizations. Responses to the questionnaire, along with information collected from on-site visits to thirteen international organizations, form the analytical basis for identifying problems and opportunities for electronic records management and archives in international organizations.

0.6 Chapter five integrates the findings from the previous chapter with the trends, applications, and opportunities identified in the first three chapters. This integration provides a series of recommendations for action at three different levels: Section of Archivists of International Organizations, institutional, and individual.

0.7 Annexes include a glossary of terms, recommended readings, a copy of the questionnaire discussed in chapter four, and suggested evaluation criteria *for computer hardware and* software.

Chapter One

TRENDS IN INFORMATION TECHNOLOGY

1.1 The world is on the verge of witnessing an explosion of information technology which will be comparable to the worldwide spread of the telephone, radio, and television. Forecasts now are being made which suggest that within fifteen years more than 200 million electronic workstations will be in place. The impact of this widespread use of electronic technology will be felt everywhere - from the work place to the home - in all societies, but particularly in advanced industrial countries. In advanced industrial countries, computers will be one of the principal foundations for an economy which will be characterized by the delivery of valuable services to customers and patrons, rather than delivery of products. What makes this possible is the decreasing cost of computer power vis-a-vis the increasing cost of people power. Generally speaking, over the last several years in the United States, personnel costs have increased about 7 percent per year while computer costs have decreased about 20 percent per year. Electronic miniaturization in which the physical size of computers has decreased while processing speed and memory capacity have increased dramatically helps account for this profound change.

MICROELECTRONICS

1.2.1 Some sense of the magnitude of decreasing size of computers is that one of the first general purpose electronic computers - known as the "Electronic Numerical Integrator and Computer" or ENIAC - occupied a room 60 feet by 25 feet at the University of Pennsylvania in 1946. ENIAC contained about 18,000 vacuum tubes and 70,000 resistors which consumed 140 kilowatts of electricity, weighed almost thirty tons, required a large and complex cooling plant, and was unreliable in performance, typically failing every couple of hours. In contrast, powerful microcomputers* the size of a brief case with thirty times more random access memory, powered by two 1.5 volt batteries, and with virtually no failure, are readily available at computer stores at a cost ranging from $700 to $2000.

1.2.2 Undoubtedly, the major factor in miniaturization is the use of semiconductor integrated circuitry on silicon chips. Intel Corporation developed the first microprocessor in 1971, which was about 1/4 inch square and contained 2,250 separate components of a circuit transistors, diodes, resistors, capacitors, and connecting wires. Five years later, large scale integration produced chips with more than 30,000 components. By 1980 there were very large scale integration chips with hundreds of thousands of components and interconnectors, at a cost of only a few dollars. (The circuitry on such large scale integration chips is equivalent to 10 years of work by one person in soldering various components onto printed wiring boards.) The future of large scale integration chips is even more dazzling since the number of components added per chip is increasing at the rate of factor of 100 per decade. This suggests that by 1990 there will be 1,000,000 components per chip. And by the year 2,000 there will be between 10 and 100 million components per chip.

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*Definitions of technical terms are given in a Glossary in Annex 1

1.2.3 The individual elements on the silicon chips are achieved by a very complex and costly photoengraving process. The dimensions of components are microscopic, in the range of 3 to 4 micrometers, or less (a human hair, typically is about 50 micrometers in diameter), which is approaching optical limits. The increased miniaturization of large scale integrated circuits (chips) mentioned above probably will be achieved through the use of X-rays and electron beam lithography.

1.2.4 These developments in semiconductor integrated circuitry have made possible greatly increased internal processing speeds and reductions in the physical dimensions of computers and their cost. Internal processing speed in a serial computer is measured in terms of "clock (or step) time", the time between the start of one operation and the start of the next. Clock time of serial computers has been greatly accelerated because of the microscopically short distance signals have to travel and the fact that resistance is practically eliminated. In addition, the capacity of today's computers to process simultaneously a larger array of bits (16 bits and 32 bits) also has contributed to increased internal processing time. However, increased speed in retrieving and transmitting data from or to an external source such as a disk drive or printer has been marginal, largely because reading and writing involve electromechanical devices.

1.2.5 As noted earlier, the physical dimensions or size of computers today are such that they occupy far less space than ever before. Integrated circuits are smaller and do not consume much electrical power or require cabinets, thousands of strands of wire, power transformers, and cooling systems. Another way of looking at this is to compare the size that one megabyte of memory has required over the years. In 1959 one megabyte of memory on the first IBM computer, a 650, (if it even had been available then) would have occupied about 400 cubic feet or the equivalent of a room seven feet wide, seven feet long, and eight feet high. By 1976 one megabyte of memory occupied about 512 cubic inches or roughly the size of a soccer ball. Seven years later the development of 64K-bit chips made it possible to store one megabyte in about two cubic inches. In 1985 the availability of 256K-bit chips reduced this storage space to less than one-half cubic inch. Thus, today the space required to store one megabyte is less than one-millionth of the space requirement in 1959.

1.2.6 Equally as dramatic is the virtual geometric decrease in the cost of computers, especially when measured in terms of the cost of one megabyte of memory. In 1978 one megabyte of memory on an IBM 370 cost about $50,000. Six years later that same megabyte of memory on an IBM 370 cost only $10,000. A single megabyte of memory on an IBM PC cost about $1,000. The cost of a single megabyte of memory has decreased about 220 percent over the last decade while the raw computing power for a given price has increased about 25 percent. It is estimated that the same amount of computing power that cost $1,000,000 in 1970 will cost about $10,000 in 1990.

STORAGE

1.3.1 The electronic storage of digital information can be characterized as fixed or moving-surface devices. The most widely used fixed electronic memory device is the large-scale integrated semiconductor chip discussed earlier. A large-scale integrated chip which stores 64,000 (64 K) bits of information has an equal number of circuits, each one of which stores one binary bit. The presence or absence of a small electric signal indicates whether the bit is a 1 or a 0.

1.3.2 Electronic memory devices provide a random access (RAM) capability which offers the fastest retrieval of stored information. Random access memory typically involves read/write or read only (ROM) capability. Read/write memories constitute temporary storage because their contents can be altered. Some read/write memories are volatile because the information must be regenerated after each operation in order to be retained and the information is not retained when the power source (external or battery) is switched off. In contrast, read only memories are non-volatile because the information is placed in the storage chip during the manufacturing process. Programmable read only memories (PROM) permit the storing of information in memory cells which are linked with small fuses. A pattern of information can be stored by applying electric signals sufficiently powerful to burn out unnecessary fuse connections.

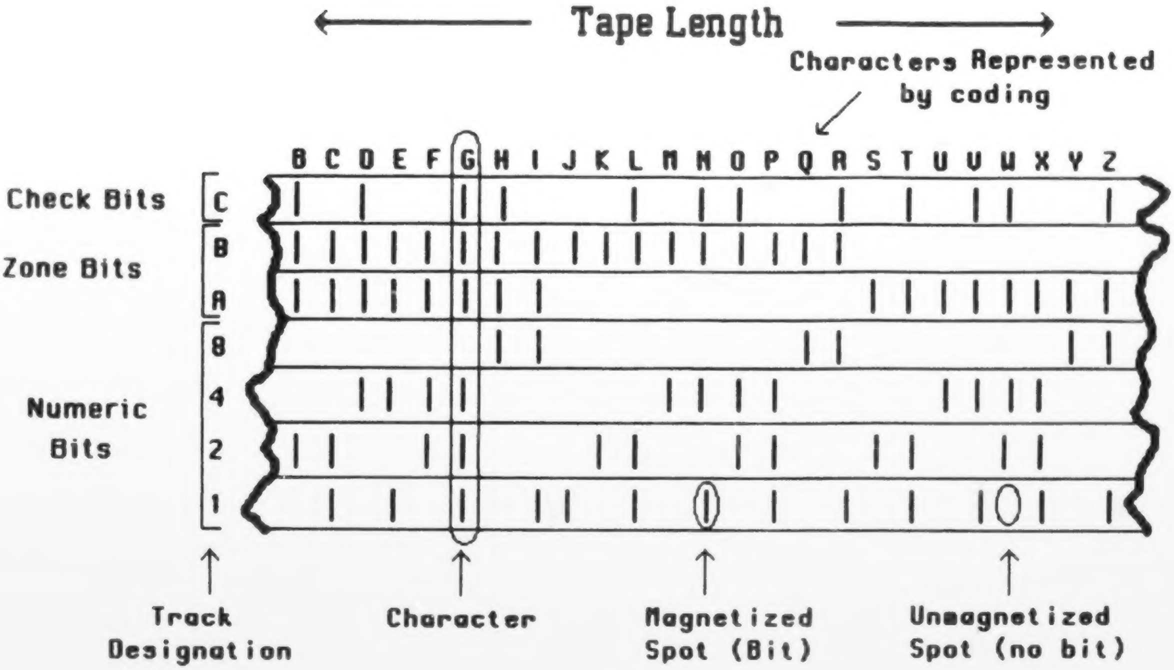
1.3.3 Moving surface memory devices store digital information (bits) in localized areas of a thin magnetic film (usually some form of iron oxide) that is bonded to a non-magnetic supporting surface. This non-magnetic supporting surface can be flexible as in mylar tape or a diskette made of plastic or it can be rigid in the form of a disk made of aluminum or similar material. Tapes, diskettes, and disks are called moving surface memory devices because they pass under a write/read head. Writing occurs when binary bits are translated into electrical impulses which pass through an electromagnetic head and are stored on the magnetic surface as magnetized spots. Reading occurs when the stored information passes under a read head and the magnetized spots induce a weak electrical current.

1.3.4 Magnetic tape is the most widely used electromechanical moving surface storage medium. It was introduced 1952 for use with the UNIVAC I, the first commercially available computer, and had a storage density of 200 bits per inch (b.p.i); the standard storage density today is 6250 bits per inch. (Figure 1.1 displays how information is actually stored on a tape.) A standard 2400 foot reel of tape written at 6250 b.p.i can store the informational equivalent of one hundred books, each containing approximately 500 pages. Continuing improvements in magnetic coatings, adhesives which bond the coating to the substrate, and write/read heads have made magnetic tape the cheapest high- volume storage medium for off-line storage. New developments, such as perpendicular magnetic recording, will lead to even greater storage densities. The serial recording mode of magnetic tape means that retrieval of specific information requires reading a tape until the specified information is found, a process that is quite expensive in terms of computer time. Nevertheless, the chief merit of computer tape is its low cost/high volume storage, which makes it an excellent means for storing information used infrequently. In addition, when a standard character set such as ASCII is used in recording information at a standard density (1600 b.p.i. or 6250 b.p.i), a tape written on one computer usually can be read on another computer.

1.3.5 Diskettes, sometimes called floppy disks because the substrate is flexible, typically are 8 inches or 5 1/4 inches in

FIGURE 1.1

MAGNETIC TAPE STORAGE


Tape Length
Characters Represented by coding
B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Check Bits
C
Zone Bits
B
A
Numeric Bits
8
4
2
1
Track Designation
Character
Magnetized Spot (Bit)
Unmagnetized Spot (no bit)

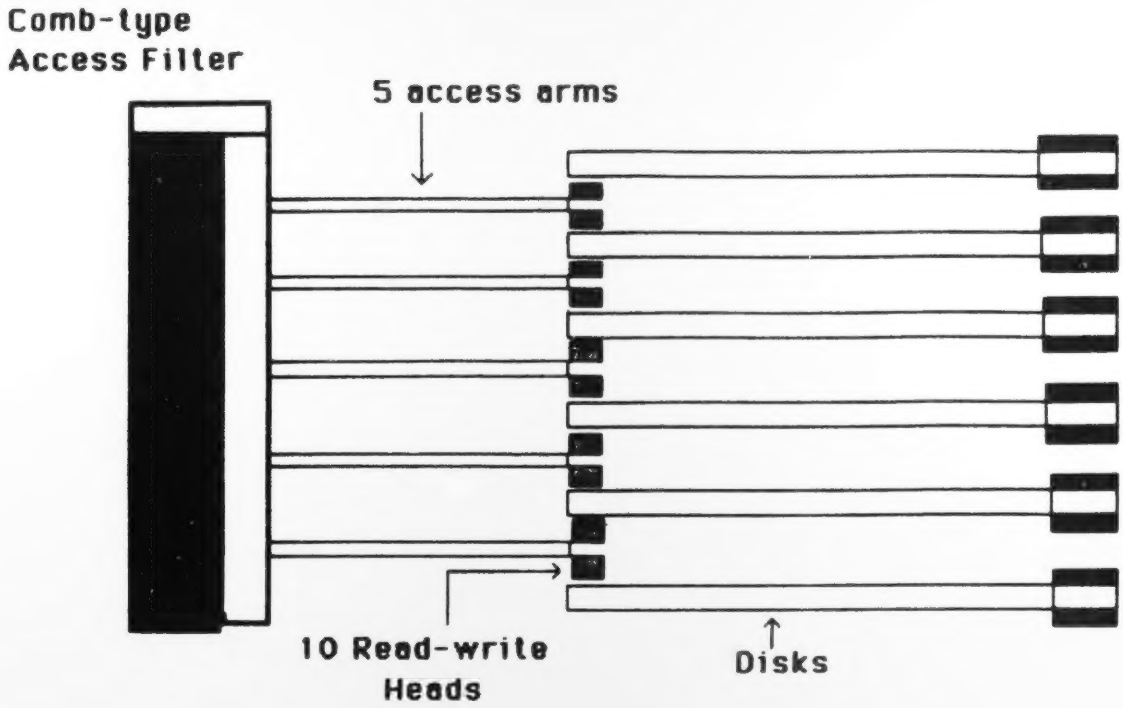
diameter and are used principally on personal computers. Some diskettes can be written only on one side while others can be written on both sides. A 5 1/4 inch double-sided disk can store 360,000 bytes of information. Information is recorded serially on diskettes in addressable sectors and tracks, which means that access time depends upon the speed at which the write/read head can move radially from one sector to another.

1.3.6 Hard disks typically consist of two or more rigid platters about 12 inches in diameter with a thin magnetic coating which are mounted on a spindle rotated by an electric motor. Access to a storage location is achieved by moving one or more write/read heads (each platter has its own write/read head) radially across the spinning disks until a specific sector and track are reached (see Figure 1.2). Information is stored in circular tracks, each of which has a unique address. Access to a specific track(s) on a disk is called direct access since the address of the track must be determined and then the access arms move to the spot on the disk matching that address. If the seek arm is near the address, it takes less time than if the address is further away.

1.3.7 The largest hard disks manufactured today are permanently mounted to a disk drive and can store from 360 to 500 megabytes of information. Other disks, usually with about 100 megabytes of storage, can be removed from a disk drive and used for off-line storage of high volume information. Hard disk drives for micro-

FIGURE 1.2

MAGNETIC DISC PACK CONFIGURATION


Comb-type
Access Filter
5 access arms
10 Read-write
Heads
Disks

computers with a storage capacity of 10 to 20 megabytes are widely available today. It is likely that this storage capacity will increase significantly over the next few years.

1.3.8 Moving-surface storage devices employ magnetic recording technology, which means that the magnetic signal can be altered if exposed to a strong enough magnetic field. Moving-surface storage devices (diskettes, tape, and disks) require even more protection because an improper environment can eventually render them unreadable. The best current statement of environmental storage conditions for magnetic media is Sidney B. Geller's _Care and Handling of Computer Magnetic Storage Media._

1.3.9 A major development in external storage technology that goes beyond electronic memory is optical digital disk technology. Optical digital disk technology is similar in some respects to magnetic disk technology in that both generally use a rigid platter(s) rotating at a high speed and employ a write/read head to deposit or retrieve information on the platter in binary digital code (1's and 0's). Recording occurs when 1's and 0's are converted to the appropriate pulse pattern of a laser beam (typically there are several million pulses of on/off states per second) which then burns sub-micron size holes on the disk surface. When the laser beam is off, no heat is directed to the disk surface. When the beam is on, the heat physically burns pits or causes some other physical distortion (such as a bubble) on the disk surface. Reading this string of 1's and 0's occurs when a lower- power laser is directed to the track in which the 1's and 0's are recorded and the resulting beam deflection indicates the presence or absence of a 0 or 1 at a particular location. Specifically, the presence of a pit (or bubble) results in little or no reflected light that can be measured or read. The architecture of a typical digital image based optical disk system is displayed in Figure 1.3.

1.3.10 Manufacturers of optical digital recorder/players have developed a variety of approaches in disk fabrication and how recording and playback occur. One manufacturer uses a highly polished glass base coated with an intermediate layer in which there are embedded tracks or grooves. A very thin film of tellurium alloy, a very soft metal, is deposited on this intermediate layer. Because of this softness a relatively low power semiconductor laser can be used to record pits in the tellurium alloy film.

1.3.11 The tendency of tellurium to degrade when exposed to humidity has led disk fabricators to develop special protection. A leading European manufacturer has developed an "Air Sandwich" which consists of two glass disks bonded to and separated by an inner and outer spacer ring. On the inner side of each glass disk is an intermediate layer on which the tellurium alloy is deposited. A transparent plastic protective layer covers the

FIGURE 1.3

OPTICAL DISK READ/WRITE SYSTEM

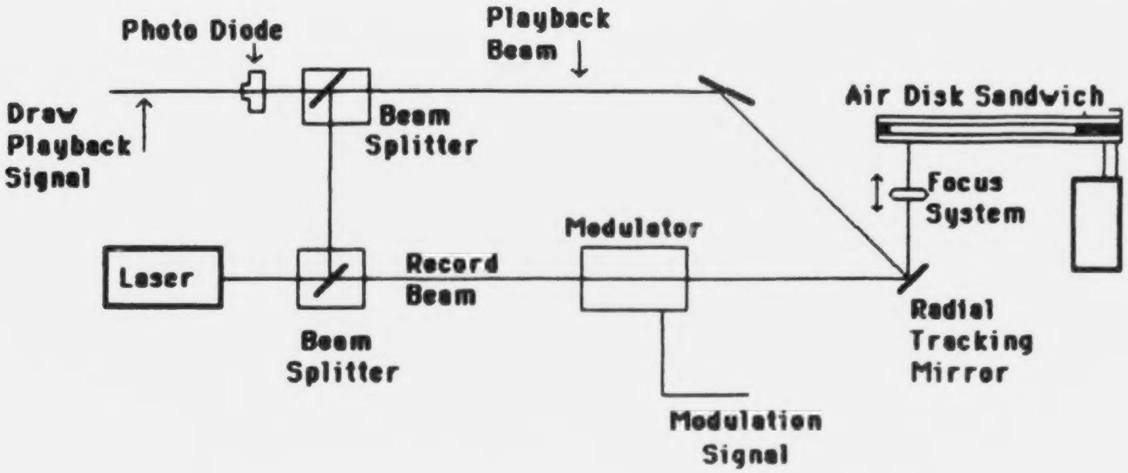


Photo Diode
Playback Beam
Air Disk Sandwich
Draw Playback Signal
Beam Splitter
Focus System
Modulator
Laser
Record Beam
Beam Splitter
Radial Tracking Mirror
Modulation Signal

outer sides of the glass disks to protect the glass from scratches, fingerprints, and dust. Scratches, fingerprints, and dust on the plastic layer cause no problems since they lie outside the focus area of the laser beam.

1.3.12 There are several advantages of optical digital disks, the first of which is storage capacity. Most manufacturers offer a 12-inch disk which will store about one gigabyte (one billion bytes) per side. A two-sided disk will store in image form (actual representation) about 40,000 8 1/2 x 11 inch page images. Measured in terms of ASCII code (as opposed to bit map patterns in document images), a two sided disk can store the information equivalent of about 1,000,000 pages. A second advantage of optical digital disks is that the very act of writing 1's and 0's causes a physical change in the disk which is not easily reversible (in contrast with of magnetic recording). A third advantage is that particles of dust, finger prints, and the like, which create serious problems in reading magnetic storage media, are irrelevant since, as pointed out earlier, they lie outside the focus area of the laser beam.

1.3.13 Critics of optical disk storage technology correctly note that the absence of demonstrated physical stability of optical digital disks gives rise to concern about their long-term use. Absent a wide-spread application base, these critics believe it is premature to view optical disks as a viable alternative to either magnetic recording or microform. The uncertainty about the long-term stability of optical digital disks must be balanced by the fact that repeated handling and reading of the disks cause no wear or abrasion, something that does occur with microfilm, microfiche, computer disks, and computer tape.

1.3.14 Notwithstanding these legitimate concerns, the application area is so dynamic that concerns noted today may well be eliminated by next month. Supporters of optical disk storage technology - and there are very many - believe that the cost of optical digital disk drives and of the disks themselves for minicomputers and mainframe computers will drop significantly, so that they will be the most cost-effective storage medium available. A good source for keeping up-to-date on optical disk technology developments is The Optical Memory Newsletter.

1.3.15 An interesting development in this regard is that several companies now market for less than $5,000 a 5 1/4 inch optical disk (based upon compact digital disk equipment) which is driven by an IBM XT or AT microcomputer. The disk will store about 100 megabytes while that of another manufacturer will store on the order of 400 megabytes. Observers of optical digital disk developments believe the successful use of Compact Optical Digital Disks with microcomputers will lead to wide spread utilization of optical digital storage technology with minicomputers and main frame computers.

SOFTWARE

1.4.1 The development of computer software (the program or instructions which tell a computer what to do) typically has not kept pace with hardware developments. In the 1960s and 1970s, when batch processing was the way most computer facilities were run, users relied upon special-purpose software written by computer programmers who were proficient in a programming language such as COBOL (Common Business Oriented Language), FORTRAN (Formula Translation), or PL/I (Programming Language I). Later, the development of general statistical analysis packages, such as BMD (Biomedical Package) and SPSS (Statistical Package for the Social Sciences), freed users from reliance upon a computer programmer, but did require considerable knowledge and skill in tailoring general purpose programs to specific applications. The concept of "user friendly" software simply did not exist since use of a computer presumed familiarity with computer jargon and processes. However, in the late 1970's as on-line access to a main frame computer became more common, a new group of users emerged who were unfamiliar with arcane computer processes and who saw no need to acquire this special skill. The needs of this increasingly larger body of users, when coupled with efforts to extend computers into a range of new applications, helped create forces which accelerated the development of computer software.

1.4.2 Generally speaking, computer software can be divided into operating systems, applications programs, and data base management systems. Operating systems software is what manages a computer. Management includes allocating the various computer resources (memory, printing, and the like) so that work proceeds smoothly. Operating systems usually are proprietary packages which are "transparent" to users, who see only the results of the operating system.

1.4.3 Application programs generally are very specific applications, such as payroll systems, which may be available as a custom developed package or as a generalized package easily adapted to specific needs and requirements. Typically, these generalized packages require some experience and knowledge about them (they are not user friendly) before they can be adapted. A more recent development is generic applications programs which can be applied to many different uses and requirements without any special knowledge of computers or computer programming. Typically, they are user friendly, are menu-driven (i.e., users may select one or more options from a displayed list and initiate them, usually with a single key stroke), are in natural English, and offer extensive help facilities. Generic applications programs can be characterized as electronic spreadsheets, graphic displays and word processing.

1.4.4 A data base management system (DBMS) stores and easily retrieves data which usually is used in an applications program. Assume that you have an outgoing correspondence registry which is automated and you want to identify and retrieve information about correspondence dealing with a specific topic signed by the head of the agency. Without a data base management system, a computer program would have to know the registry number of each correspondence citation in order to retrieve it. With a data base management system, however, the relevant information could be identified and retrieved based only upon the specified topic and name of the sender (head of the agency). Data base management systems can be characterized as flat, hierarchial, and relational Relational data base management systems are very powerful retrieval tools and are available from many vendors for both microcomputers and mainframe computers.

1.4.5 An information retrieval system is a system used to store textual information which is to be processed, searched, retrieved, and disseminated to users. Typically, information retrieval systems used bibliographic and/or textual documentation (records). This is a crucial point, since the information being processed consists of documents or document surrogates and the system is designed to retrieve documents. In contrast, data base management systems deal with the storage, maintenance, and retrieval of factual information in an explicit form, that is, not in a natural language narrative text. Rather, information is arranged into specific data elements or fields with each field containing the value for specific characteristics or attributes associated with that field.

1.4.6 A critical aspect of information storage and retrieval systems is file structure or the way the information is arranged and indexed. The simplest file structure is a linear list which is simply an unordered collection of information items or documents. The entire file must be searched in order to locate a specific item. Ordered sequential files contain information items or records in a specified order, such as alphabetic order by author name. The existence of a specified order (numerical or alphabetic) means that a binary search can be conducted at a great saving of time. Indexed files provide access to segments of a file. For example, an index may be constructed which uses the first letters of authors' last names in an ordered sequential file. Thus, an indexed file permits search of only that portion of the file specified by the index. One disadvantage of indexed files is that when new records are added, both the file and the index must be updated.

1.4.7 An inverted index file provides rapid access to information items because the index alone is searched in order to identify those items satisfying a search request, rather than the actual file of items. An inverted index file identifies all information items associated with a given term or word and usually consists of pointers or retrieval citations to a document file. The software supporting retrieval from inverted index files usually permits Boolean searches. Boolean searches use the logical operators "equal", and", "or", and "not" singly or in combination to identify documents meeting certain specified criteria. Assume, for example, that the terms records and management are included in an inverted index. A search for references to records management would specify "records" and "management." The system would first retrieve all document numbers or identifiers associated with "records" and then repeat the process for "management." The system would then determine which document numbers are in both lists.

1.4.8 The chief advantage of an inverted file design is that it produces rapid response time, especially when using Boolean operators. Its limitations are significant. The inverted file itself may be larger than its associated data base, requiring extra storage capability. If the data base itself is dynamic, the inverted file must be periodically updated, which can become quite costly. In addition, conventional browsing is not easily done. Instead, it is necessary to formulate complete and specific queries at the outset in order to retrieve citations to an entire set of relevant documents or items. The citation itself is then used as a retrieval key to the document itself, which can be displayed on the screen. Finally, most inverted indexed files do not permit simultaneous searching of multiple data bases.

1.4.9 In contrast to an inverted index file, a full text search file (sometimes called free text search) requires no indexing terms as such, although fields can be identified where a search is to be confined. In a full text search system, the hardware is configured in such a way that every document can be scanned very quickly for any word or combination of words that the user defines. Its advantages include elimination of the need to index documents (either automatically or manually), with all of its attendant problems (updating the inverted index, maintaining authority files, and high storage requirements); freedom for users to formulate unstructured queries (within system constraints); and conventional browsing of documents. Evaluation criteria for evaluating information storage and retrieval systems are listed in Annex 2.

1.4.10 Word processing programs, or more correctly, packages, are designed to make it easy to create, edit, and print out textual material (as opposed to data processing). With word processing packages no computer skill or knowledge is presumed or required. Indeed, the only requirement is the same facility for using a keyboard that is required of anyone using a typewriter. The better word processing packages are menu-driven, have special function keys, and offer extensive help facilities.

1.4.11 It is generally agreed that generic applications software is becoming easier to use and more reliable. There is an increasing variety of packages available, particularly for microcomputer use. As hardware improvements have led to increased computing power for users, software developers have used high-level languages in developing very powerful packages (usually, the programs are very complex, but this is "transparent" to users) which permit people to deal with computers on their own terms and generally in natural or free English. Eventually, the software capability to access computers with the same skill level that is now required to use a telephone network will be developed. J. S. Mayo, Executive Vice President for AT&T Bell Laboratories uses the analogy of electric motors to argue that "today's software problems are transitory." This analogy builds on the fact that initially electric motors users had to hook them up to functional tools, such as saws, drills, and the like. This was awkward at best and meant that power tools had limited use. However, as the technology of electric motors developed, tools and devices such as saws, grinders, washing machines, and the like contained their own motor. User needs, therefore, were met by functioning systems containing motors that were readily available and relatively inexpensive. This analogy suggests that eventually a wide variety of products will be available to users which will contain software just as dishwashers, for example, contain a motor. Users will not care about what is inside, as long the function is performed. In short, functional software-based products eventually will eliminate many of today's software problems.

DATA TRANSMISSION

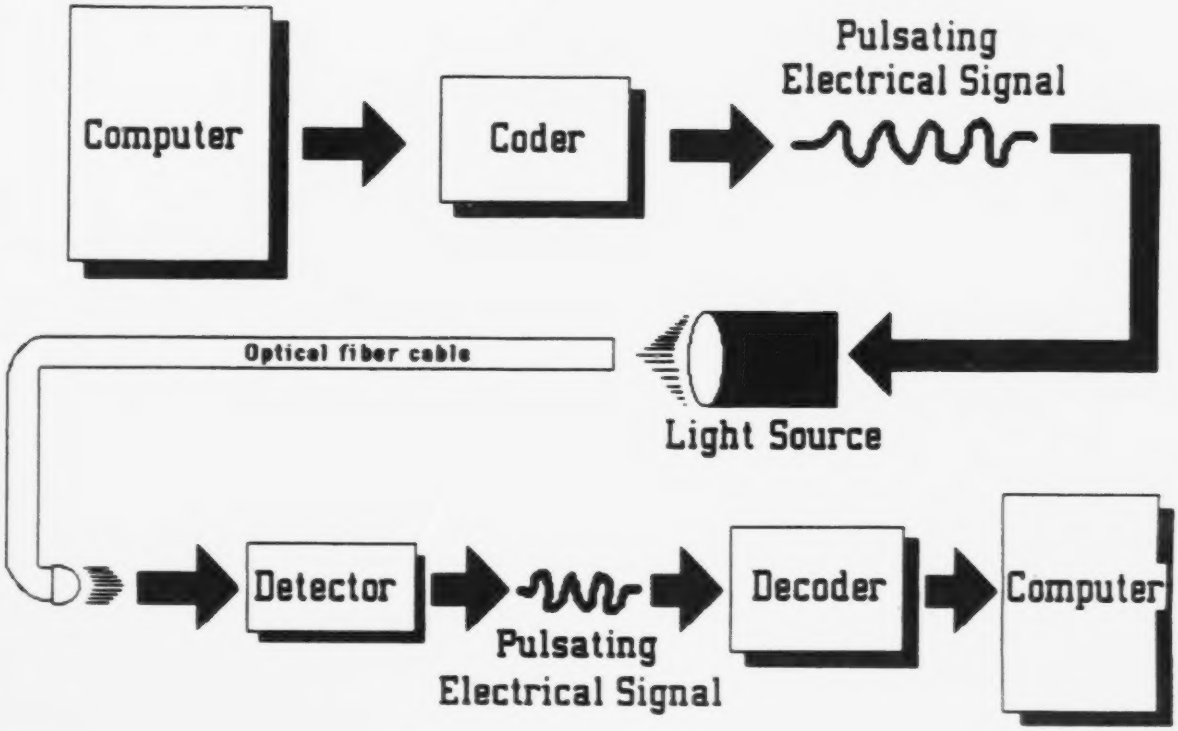
1.5.1 Going almost hand-in-hand with the trends and developments already discussed are developments which permit the transmission of large amounts of digital information. The traditional way of transmitting digital information from one computer to another is to use copper wire to carry signals. Although a superb conductor of electricity, copper wire (coaxial cable) is not well-suited for transmission of digital information over a distance greater than 2,000 feet. One solution has been to convert digital signals into analog signals and transmit them over telephone lines. Transmitting analog signals over telephone lines involves slow transmission rates and high error rates, caused in part by amplifiers which can not distinguish between a good signal and static. Even the use of microwave signals, which are bounced off satellites, still does not provide the capability for transmitting large amounts of digital information.

1.5.2 Two developments over the last decade or so are changing this situation. First, in 1960 the invention of the laser beam, which can be focused to a very narrow beam of light and is very stable in terms of light constancy, made it possible for the first time to test seriously the theory that light could be transmitted over a dense optical medium such as glass, if the striking angles of the light are kept low enough so that they cannot escape to the atmosphere. The laser beam itself can produce hundreds of millions of pulses per second, which can represent the 1's and 0's in a digital bit stream. The second development was a manufacturing process which could produce glass fibers of sufficient purity to transmit a laser beam light with little or no signal loss. By 1978 this was achieved through a reduction of fiber impurities and the development of coatings with refraction characteristics that reduce the dispersion of light. FIGURE 1.4 identifies the key components in a fiber optics based transmission system.

1.5.3 A fiber optic line consists of a single glass fiber (smaller than a strand of human hair) that carries signals at the speed of light and is impervious to external electric or magnetic interference. Indeed, the only way to intercept or interfere with fiber optic transmissions is through actual physical access into the cable. Unlike electrical signals, light pulses do not require periodic amplification, with all of its attendant problems. Light pulses transmitted over fiber optic lines do require refreshment (every 30 kilometers), although in laboratory experiments distances as great as 125 miles have been achieved without any refreshment of the signal. As the power output of

FIGURE 1.4

FIBER OPTICS TRANSMISSION


Computer
Coder
Pulsating
Electrical Signal
Optical fiber cable
Light Source
Detector
Pulsating
Electrical Signal
Decoder
Computer

lasers increases and breakthroughs in new materials for fibers occur, increasing the distance from 125 miles to several thousand miles is likely to be achieved.

1.5.4 Since the data transfer rate of fiber optics is as great as three to five megabits per second, the volume of information that can be quickly transmitted is enormous. A data transfer rate of 3 megabits per second would mean that the entire thirty volumes of the Encylcopedia Britannica could be transmitted from Washington, DC to Los Angeles, California in a matter of several minutes. Some sense of the magnitude of the data transmission rate of fiber optics is given in Figure 1. 5, which includes theoretical comparative data transfer rates for several different carriers.

NEW COMPUTER ARCHITECTURE

1.6.1 For almost three decades computer architecture has been largely conditioned by the work of John von Neumann, whom many people would acknowledge as the father of the modern digital computer. Neumann's approach was to design a computer around the concept of a main processor containing limited memory in which programs were stored, and small batches of data were moved into memory from an external storage device for processing and then returned to the external storage device. This was a brilliant solution that is reflected in the notion of mainframe or centra-

FIGURE 1.5

DATA TRANSFER RATES

Carrier	Characters Per Second	Time to Transmit Encyclopedia
1200 BAUD	120	833 hours
copper wire	5,000	20 hours
satellite	100,000	1 hour
fiber optics	3,000,000	.03 hour

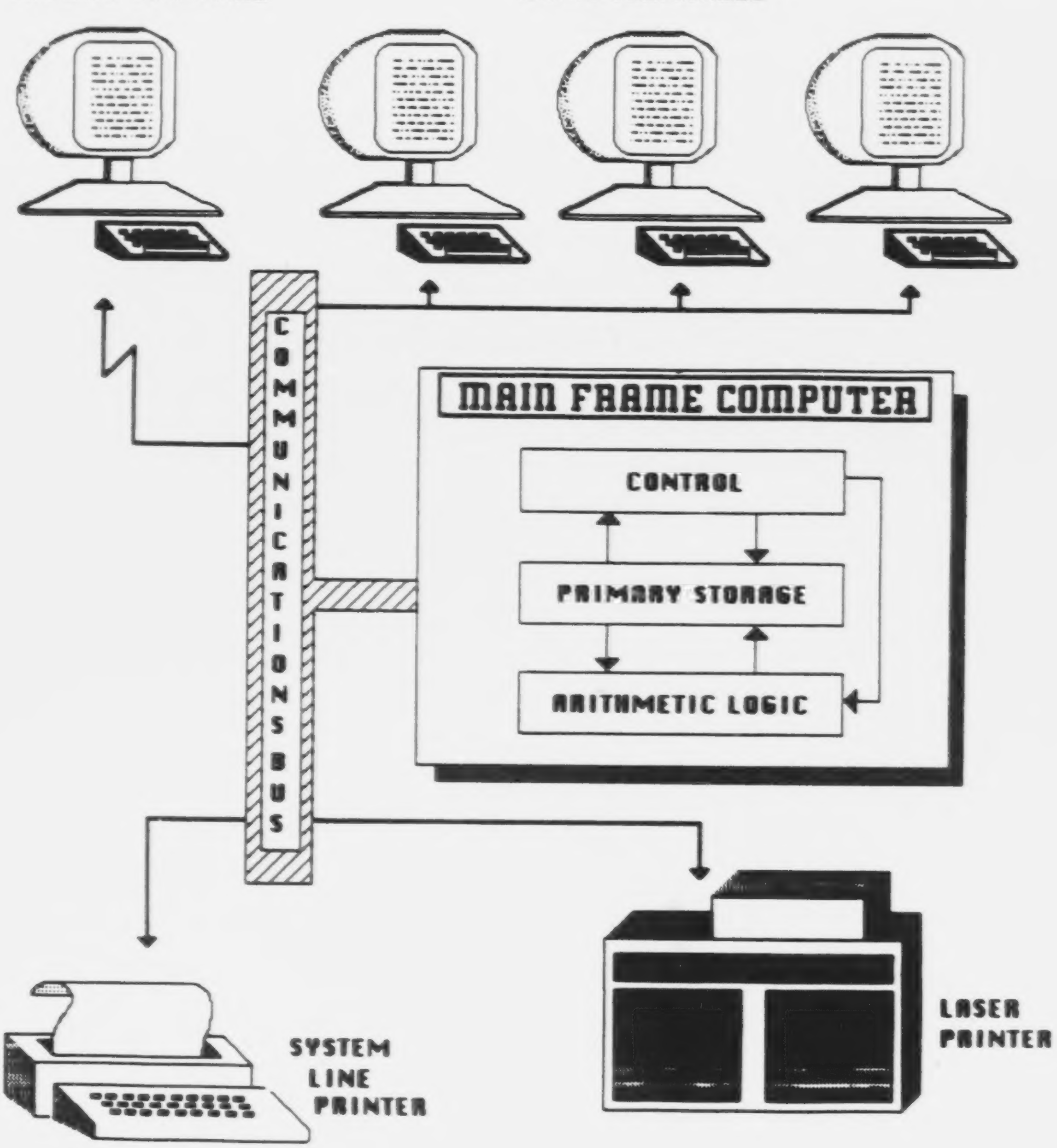
lized computer processing in which operations are serial. (Figure 1.6 illustrates the key components of a mainframe computing system.) Serial processing, however, is very inefficient, since most of the computer's time is spent retrieving and storing data.

1.6.2 In the 1960's and mid-1970's the term main frame computing system typically was applied to computers with the fastest speed, largest functional size, biggest physical dimensions, and greatest monetary cost. In such a main frame computing system all system operations were centralized in one central processor unit at one location. A job could be entered into the system by computer center personnel or by the user from a remote terminal (if the job required data already stored on a magnetic tape or disk in the computer room). The job entered a work queue and shared portions of the central processor unit and peripherals (printer, for example) with other jobs in what was called a multi-processing mode. Users were in a passive mode and had no direct control over the processing activity. Any changes in the data processed or the functions performed usually required the intervention of a member of the data processing staff (systems analyst or programmer) who would make the necessary changes.

1.6.3 As noted earlier in this chapter, microelectric miniaturization trends have led to increased speed and decreased size and cost of computers. While some manufacturers were producing

FIGURE 1.6

MAIN FRAME SYSTEM

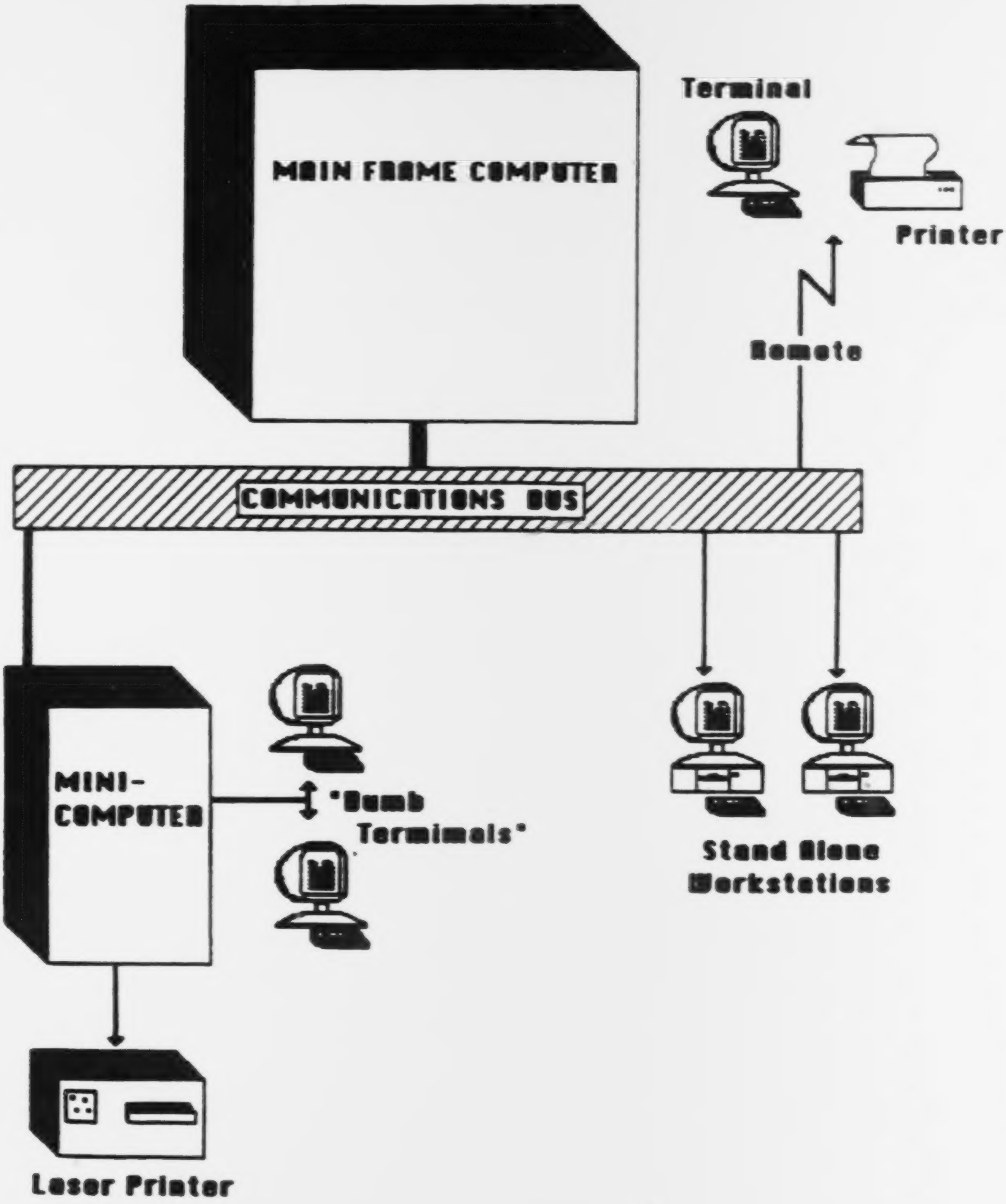

REMOTE TERMINAL
"DUMB TERMINALS"
COMMUNICATIONS BUS
MAIN FRAME COMPUTER
CONTROL
PRIMARY STORAGE
ARITHMETIC LOGIC
SYSTEM LINE PRINTER
LASER PRINTER

main frames that were faster and larger, other manufacturers were concentrating on smaller but very powerful computers. Consequently, these computers were called minicomputers, primarily because of their decreased size and cost. However, for all intents and purposes their architecture still reflected a centralized processing environment.

1.6.4 The first significant shift away from the von Neumann computer architecture occurred in the late 1970's with the introduction of distributed computer systems, the major components of which are displayed in Figure 1.7. The key distinction between a centralized computing system and a distributed computing system is that the latter consists of a powerful central minicomputer for large tasks and geographically dispersed small computers (or "dumb terminals" which lack any internal processing capability) under the immediate control of users. Sometimes, data files are stored at the central computer and are accessed by users as they are needed, thus reducing both the volume and cost of data transmission as well as the workload on the central computer. Although users can interact directly with the computer and can control or modify some parts of the processing functions, distributed systems still are an extension of centralized data processing. Many office automation (OA) systems, which typically employ "dumb terminals" or personal computers linked to a minicomputer file-server, fall under the rubric of centralized data processing.

FIGURE 1.7

DISTRIBUTED SYSTEM


MAIN FRAME COMPUTER
Terminal
Printer
Remote
COMMUNICATIONS BUS
MINI-COMPUTER
"Dumb Terminals"
Stand Alone Workstations
Laser Printer

1.6.5 A far more significant shift away from a traditional computer architecture is seen in an outward evolution to open systems in which users can communicate and easily exchange data, text, and graphic images through one or more electronic networks. One step in this direction is the development of local area networks (LAN), which is an electronic network that helps users use different microcomputers (or dedicated word processors), disk drives, or printers at the same time. A local area network, which generally includes one office or a single building, permits people to share hardware and software that are physically located within about a 2,000 foot radius. Typically, a local area network provides word processing, electronic mail, electronic files, graphics, and calender services. Local area networks can become part of an expanded network composed of a number of different networks. The key to such access is the development of protocols which serve as gateways between these different networks and permit users to pass through these gateways without necessarily knowing or understanding precisely what is happening.

1.6.6 A key component in electronic networks, which substantially reduces communication costs and increases performance, is packet switching. In a local area network getting data - a stream of bits - from one computer to another involves use of a hard-wire connection (cable) or modem over dial-up telephone lines. Generally, a modem permits only one user on a circuit at a time, which can make electronic communication very costly. A technique which can reduce this cost as well as improve performance is called packet switching. Packet switching involves taking a fixed number of data bits (or bytes) and putting it in an "electronic envelope" which may include originating address, destination address, sequence number of this particular group of bits, and any other necessary control information. Packets are sent over shared communication lines, with each packet being sent over the communication line that is available, without regard to what route other packets are sent. The receiving computer automatically restores the proper sequence of the packets so that data integrity is restored. The chief advantage of packet switching is that with many users sharing the communication lines, a computer can select the alternative routes and ensure that all available lines are in use. Protocols and gateways, discussed earlier, are very important since there are enough differences in packet switching techniques in different computer systems and networks that these standards and protocols make it possible for users to move from one network to another or to attach their computers to networks involving computers from another vendor. These standards are crucial in establishing efficient packet switching and by extension computer networks and will be discussed in some detail in chapters two and three.

1.6.7 A very fundamental shift also is evident in recent developmental work of machines designed for artificial intelligence operations in which large amounts of data must be searched repeatedly and rapidly. Called associative memories in this context, parallel processing involves the simultaneous processing of discrete pieces of data as part of a whole through the use of special purpose microprocessors or text array processors. The solution to high speed searching and retrieval from large data bases, therefore, is based upon computer hardware, not software. To illustrate this, assume, for example, you have 50 documents, each of which has about 2,000 words, and you want to identify and retrieve those documents in which the words archives and records management are used. If there are five parallel microprocessors which handle four bytes at a time, then the search is speeded up by a factor of five or more. One company uses parallel processors to process about 1,000 8 byte words simultaneously, which translates into a speed of more than 600,000 characters per second. Another company uses an array of 128 query processors (text array processors) to do parallel word searches at a rate in excess of 60 billion words per minute. The greater the number of parallel processors, the greater the increase in speed in identifying and retrieving specific documents. The importance of developments in parallel processing are clearly related to the feasibility of full text searching of information storage and retrieval systems, discussed earlier in this chapter.

1.7.1 The power and speed of new computer architecture and associated data transmission and storage developments, among others, which were previously discussed, make little difference if there is no electronic digital data to process. This situation usually occurs when there is a transition from a paper-based information handling system to an electronic one, since the bulk of the information accumulated over time is on paper or microfilm. There are four known ways to convert a document image to digital format: key stroking by a date entry operator; voice or speech pattern recognition; optical character recognition; and raster scanning. Key stroking is analogous to typing since it consists of typing or entering information into a data base. Voice or speech pattern recognition is a technology that permits a user to enter data into a computer or give oral instructions to a computer. Optical character recognition (OCR) automatically enters information into a computer data base by "reading" printed, typed, or handwritten material and translating it into digital character codes. A raster scan is an application of digital facsimile transmission technology in which a page image is captured and converted into a digital code that can be displayed as a visual image. The essential difference between optical character recognition and raster scanning is that the latter manipulates images only as visual items and cannot interpret text or numbers and process their content.

1.7.2 The concept of having a machine automatically recognize human speech, convert it into computer processable form, and then display this on a screen is straightforward and relatively easy to comprehend. The key components in such a conversion technology are an input unit for receiving the human speech and converting it into an audio signal (analog), a device to convert this analog signal into a digital representation, a unit to compare this digital representation with another set of digital representations in a vocabulary stored in a computer, and a unit to convey all of this to the user.

1.7.3 The input unit can be viewed as a simple microphone or telephone in which the sound waves of human speech are converted into analog electric signals. The analog signals are converted into digital signals (1's and 0's) by a conversion device that takes thousands of sample readings per second and transforms them into digital bits. This digital representation of human speech is then analyzed by a computer and compared or matched with the digital representations stored in its vocabulary. If the digital representation with the best "match" falls within a predetermined level, then a response is stored and displayed on a printer or screen, or spoken back to the user if the system synthesizes speech.

1.7.4 Despite considerable research and development activity, automatic speech pattern recognition is not a mature technology. Vocabularies on operational systems are quite limited - usually 50 to 100 words - and these systems typically require that each word be preceded and followed by a silence of between 100 and 200 milliseconds in order to minimize the possibility of acoustical distortion when words tend to run together. A study conducted by the U. S. Postal Service in 1983 suggests that key board entry may be more accurate and as fast as automatic speech recognition devices, especially when entering numeric data. Automatic speech recognition technology must grow and become more robust and capable of handling the complexities of normal human speech before it can be considered a viable data entry technology.

1.7.5 Optical character recognition (OCR) devices, which convert typed material, handwritten material, and typeset material into a form for computer processing, are a very robust data entry technology. A typical OCR system has three major functions: detection, recognition, and output. Detection consists of optical devices which "see" a particular black pattern on a document and determine if it is a "known" character, a mark, or a bar code. Interpreting this black pattern in terms of being a specific character is the recognition process. Output of interpreted characters can include on-line use in a word processing system, an information storage and retrieval system, and type setting for publication purposes, among others.

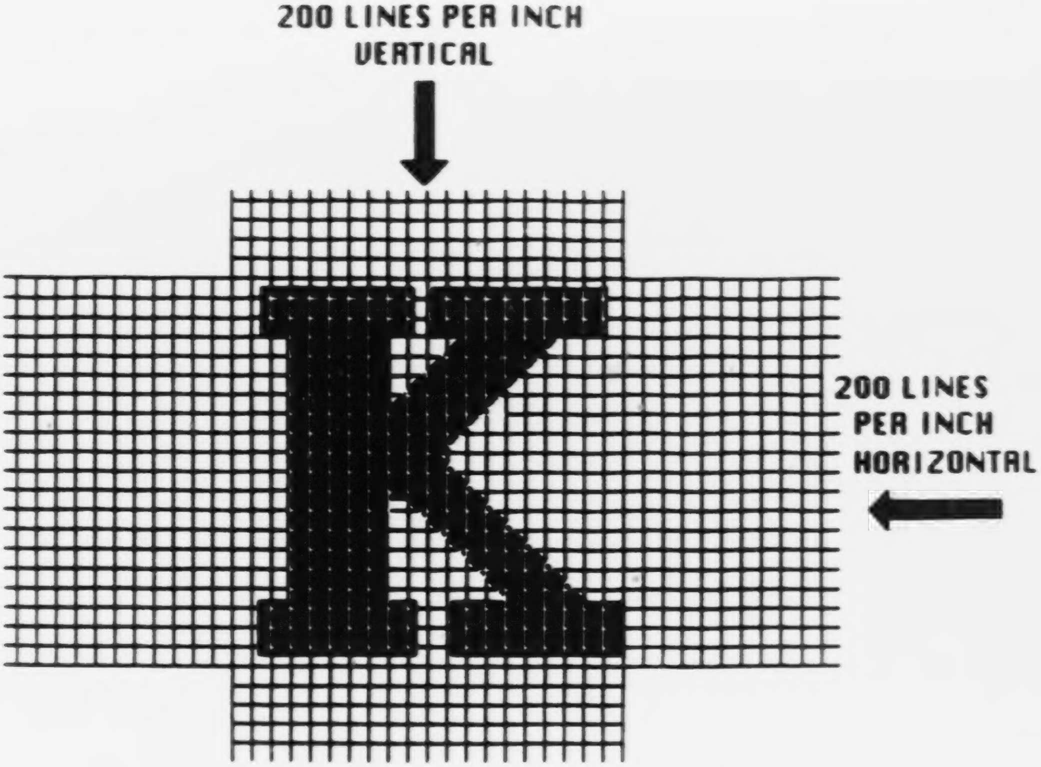
1.7.6 More than thirty companies manufacture a variety of optical character recognition equipment. However, most of this equipment is limited to "reading" a limited number of type fonts that typically include OCR-A, OCR-B, and output from Selectric typewriters and Daisywheel printers. At least three companies claim that there are no limitations on the number of type fonts their systems can read. In addition, one company advertises that it can also process non-English handwritten material (as long as it is reasonably legible) or poorly-typed material without regard to type font with a guaranteed error rate of 2 characters per 10,000 characters. This capacity to convert poorly typed material or handwritten material into machine-readable form at a reasonable cost and with a very low error rate, which has been publicly demonstrated a number of times, suggests that this particular optical character recognition technology will be widely used in converting existing paper-based information to machine-readable form. The U.S. National Archives has conducted tests of several optical character recognition technologies, including the one that reads handwritten material. For more information on OCR see The Technology Assessment Report cited in Annex 4.

1.7.7 Raster scanning is a process used to convert the image on a paper or film into a computer code. Once the image is in this computer code, it can be enhanced, stored, and retrieved very efficiently. The actual scanning process begins with a page(s) being fed into a machine (much like feeding paper into a photocopy machine). A scanner light, usually a laser beam or a charged couple device, is divided into thousands of tiny units which in turn divide the page into a matrix or grid of microscopic picture elements or pixels, each one of which typically represents about one-millionth of the page image area. The amount of light reflected off each pixel is proportional to its blackness or whiteness. This analog signal for each pixel is converted into a digital bit stream accurately representing the light and dark areas. In this conversion, computer software, based upon complex algorithms and user defined thresholds, determines at what point a shade of gray is more black than white and converts each pixel to either a 1 or a 0. Figure 1.8 illustrates scan density and image thresholding.

1.7.8 One of the strengths of electronic digital images of page images is that it is relatively easy to improve poor image quality. Image enhancement can have the effect of increasing contrast in light originals, reducing background discoloration, or adding crispness to fuzzy line edges. Extraordinary results in image enhancement can be achieved by modifying algorithm parameters and combining techniques that are appropriate for a particular document type.

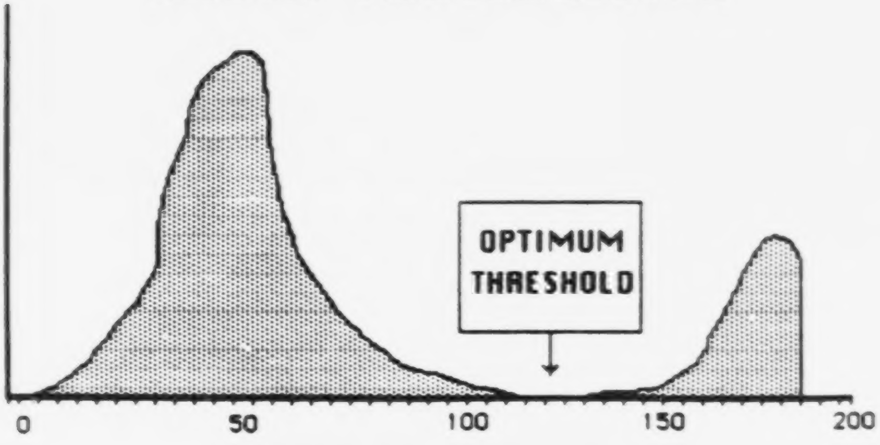
FIGURE 1.8

SCAN DENSITY


200 LINES PER INCH
VERTICAL
200 LINES
PER INCH
HORIZONTAL

ALPHA CHARACTER "K" AT 1/10 INCH

IMAGE THRESHOLDING



HISTOGRAM OF TEXT IMAGE

1.7.9 In the summer of 1984 the U.S. National Archives conducted several tests of raster scanning and image enhancement software, using archival documents. These results are very impressive and suggest that raster scanning is on the verge of becoming a very mature technology which can be a very cost effective way to convert page image material to digital electronic signals. Page image material in this format can be stored on any computer storage medium (magnetic or optical). It can be transmitted quickly from one location to another or duplicated and used simultaneously in several locations. And it requires far less storage space, not an unimportant consideration in many projects.

Non-Digital Storage

1.8.1 Computer-based storage and retrieval systems are not limited to magnetic tapes and disks or optical disks. An alternative is computer-based micrographics systems which combine the speed and accuracy of computers with the high storage capacity of microfilm (or fiche). One hybrid system is Computer-Output Microfilm (COM), in which information processed by a computer and normally printed out on paper is instead stored on microfilm (16 mm roll microfilm or microfiche) in page images in the form of tiny photographs. COM devices are tied directly into a computer system (main frame, minicomputer, or microcomputer) and generally are used to store information which is likely to be inactive. Dry COM processors use a laser beam to expose microfilm that is heat-processed so there are no chemicals or mix to replenish and the film emerges from the process dry and ready to be used. Two major benefits of COM are its low cost when compared with magnetic storage and high volume reduction. With regard to the latter, a 1,350-page printout measuring 4 inches high could be reproduced (24X) on a single 100 foot roll of microfilm or twenty-two microfiche cards. Since page images are usually stored sequentially with no indexing pointers, retrieval of a specific page is slow and cumbersome.

1.8.2 Computer-Assisted Retrieval (CAR) systems, which sometimes are incorrectly described as electronic filing systems, enable users to capture images of incoming documents on coded 16mm microfilm or microfiche, store these film images in a file linked to a computer, and then retrieve specific documents as needed. A typical CAR system includes one or more incoming document storage stations and one or more page image retrieval stations. The key element in a CAR system is the software that supports document indexing, which usually includes subject terms, file classification number if used, date, sender and recipient of the document, and a brief abstract.

1.8.3 To retrieve a specific document when the document file number is not known, a user queries the index data base from a terminal. If there are any "hits" or matches between the query terms and index terms in the data base, the number will be displayed on an image screen. A summary of indexing information also is available for display. If the abstract information indicates this is the correct document, there generally are two modes of retrieval, depending upon the complexity (and cost) of the CAR system. Most CAR systems offer a fairly simple retrieval capability that requires the user to physically retrieve the specified roll of microfilm (magazine cassette or microfiche jacket) and insert it in the retrieval station. Under computer control, the retrieval station searches the microfilm at speeds of up to 600 images per second until the specified film image number is reached. This image is then displayed on the screen. Some CAR systems have a mechanical unit which handles all aspects of retrieval of the film, including refiling. In these systems, the entire retrieval operation can be completed in a few seconds.

1.8.4 Other CAR systems, which are more costly and complex, electronically display the page images by scanning the film image and converting it into a digital bit map pattern which is then displayed on a terminal screen. In this kind of CAR system the search and display can be completed very rapidly. In addition, since the film image never leaves the central storage area, it can be scanned and displayed almost simultaneously for multiple users. The chief advantage of this kind of CAR system is that it can provide multiple user access to active files.

1.8.5 Advanced micrographic electronic filing systems, which are not yet commercially available, integrate word processing, micrographics equipment, and minicomputers into a very powerful system. The system software is the key element in these systems since it keeps track of what is going on and instructs each component what to do. An advanced film based electronic filing system requires equipment and software to capture automatically incoming page images on microfilm with users assigning index material for retrieval purposes. Copies of outgoing page images, which are created by word processing, also are stored on film. An electronic file of documents (ASCII character string), which is maintained on a hard disk, is periodically transmitted to a central computer which has a program for automatic assignment of indexing or retrieval terms. After the automatic indexing is completed and film image numbers are assigned, the word processing files are sent to a COM unit which produces roll microfilm or microfiche.

SUMMARY

1.9.1 This review of trends in information handling technology has highlighted a number of significant developments which now or soon will drastically alter the environment in which archivists and records managers of international organizations will function. Probably the two most significant dimensions of this new environment are the widespread availability of microcomputers and the development of integrated information systems.

1.9.2 The broad range of information processing features that microcomputers offer and the variety of software programs available, make them very attractive tools to increase productivity and efficiency. Microcomputers put the power of information collection, storage and retrieval, exchange, manipulation, and printing into the hands of individuals. In doing so, microcomputers raise privacy, security, and management issues that had been irrelevant or dormant in other eras of information processing. The potential for microcomputer users to create their own system of records is, in effect, a decentralization of recordkeeping, and greatly compounds the difficulty managers who are responsible for keeping track of systems of records will face.

1.9.3 Related to the widespread use of microcomputers is the clear shift from a focus on data processing, in which computer power and memory were dedicated to the processing of data, to a focus on information processing which includes data processing, word processing, micrographics, and electronic publishing, among other things. This reflects a breakdown in the traditional boundaries separating various information specialities with what appeared to be separate and distinct technologies. The incorporation or integration of various functions and processes into the design of information systems is clear evidence that industrialized countries are information-based societies. Thus, the emphasis of an industrialized technology, which was both centralized and specialized, is giving way to the focus of an information-handling technology that is decentralized and integral.

1.9.4 This, of course, is part of the rationale for this study. However, before getting into a discussion of how archivists and records managers can deal with information handling technologies that both decentralize and integrate recordkeeping activities, it may be useful to examine in greater detail specific applications of some of the information handling technologies discussed in this chapter. Therefore, the next chapter will focus upon applications which exploit some of the trends just reviewed.

Chapter Two

RELEVANT ELECTRONIC TECHNOLOGY APPLICATIONS

2.1.1 The focus of this chapter is on hands-on research or implementation projects in an environment familiar to most archivists and records managers which illustrate some of the trends and themes discussed in chapter one. Among the topics to be covered are office automation, electronic mail, data exchange standards, optical disks, computer-assisted retrieval of microfilm, text conversion, and artificial intelligence or expert systems.

Office Automation

2.2.1 Although there are many office automation projects underway, perhaps the most interesting one from the perspective of archives and records management is sponsored by the Public Archives of Canada and the Department of Communications. A major goal of the project, which began in June of 1984 after a year of planning, is to examine the impact of introducing an integrated electronic office communications system in the Broadcasting and Content Services Policy Branch, which numbers about thirty-five analysts and support staff. Other intended users of the system were the Minister, the Deputy General, and key senior officials.

2.2 The project called for an integrated office system which would offer users a wide range of functions and services, beginning with word processing to create, revise and print narrative material. Equally as basic was the requirement that the system support electronic spreadsheets for creating, revising, and printing statistical information. An electronic messaging capability to transmit documents and messages throughout the user network was another critical requirement. A logging and tracking system to keep track of the progress of documents from a draft stage to the approval stage and to produce management reports was another function the system had to support. Finally, the system had to offer the capability to create, store,and display graphic information. All of these functions had to be as user friendly as possible.

2.2.3 Comterm, Inc. of Pointe-Claire, Quebec, was selected as the supplier of the integrated system. Comterm developed a system which supports seventy-six IBM compatible personal computers as intelligent work stations. Each personal computer has at least one floppy disk drive and 640 K internal memory. A single file server consisting of an IBM AT with a 140 MB hard disk drive provides the basic networking capability. The operating system which supports the local area network and links all of the various applications programs, such as word processing, spreadsheets, and data base management systems, with the operating system of an individual person computer workstation, is called NESTAR. It is also referred to as a "shell" which acts as an interpreter between a computer and users. This shell is user-friendly and is menu-driven in either French or English.

2.2.4 Users at individual workstations can use internal memory and floppy disks in any way they choose. However, when workstations function as part of the network there are certain constraints. Each user is limited to the storage space on the file server that is the equivalent of 150 pages. Additional space is made available for group projects and documents. The file server also functions as an electronic corporate archives where documents are stored after the appropriate official has signed off on them or electronic mail messages are read. This corporate electronic archives mimics a hard copy archives system. In addition, in the pilot project a staff member reviews each document to ensure that user supplied subject terms are correct or appropriate.

2.2.5 One of the interesting features of this shell is electronic mail. To send mail to another user on the network you select from the main menu the "Send mail" option. A form is displayed on the screen which includes the subject and space for the message. This message may be confidential (restricted to the recipient) and can be assigned a priority. Finally, you select the recipient of the mail. Executing the "send" option means that the message will immediately go the recipient's in-box along with the sender's identity. Once the message is in the recipient's in-box, the word "mail" appears in the status window of the main menu. The system automatically records when messages have been read and deletes them from the sender's out-box. Another feature of the electronic mail system is the automatic assignment of a document or message to what is called the "corporate archives" as soon as a recipient reads a document or message and appropriate action has been taken.

2.2.6 Another interesting feature of the shell is a document and task management system which participants rate as one of its more valuable aspects. This electronic system mirrors the existing routing and approval process of a paper based system and provides instantaneous information about who has a specific document and what remains to be done. Once a document completes the routing process and is approved, it is automatically transferred to the corporate electronic archives. A major problem, that of transferring the corporate electronic archives to the central archives of the Public Archives of Canada, will be addressed before the pilot project is completed in March 1986.

2.2.7 The Public Archives of Canada will issue a final report in early 1986. In the meantime a preliminary report offers several general observations about the introduction of integrated office systems. Careful planning with a multidisciplinary team that includes user participation is absolutely essential. In addition, it is important that there is in place a corporate-wide policy articulating the principles and principles which govern the management of all recorded information. A corollary is the requirement for a corporate-wide records management program that standardizes the indexing, retrieval, retention, and disposal of documentation. In the design of an integrated office system, archivists and records managers are key players in discussions that lead to the development of both functional and technical specifications and procedures users of the system must follow. Related to this is the need for users to have input into the development of the general approach and specific guidelines that are brought to bear in determining which types of documents are to placed in the electronic filing system.

Electronic Mail

2.3.1 Although electronic mail was covered in the previous discussion of office automation, electronic mail apart from an integration office system is being widely promoted and used and undoubtedly will have a major impact on the way international organizations handle electronic information. This review of electronic mail projects focuses upon a cooperative effort of sixteen United Nations orgnizations to test electronic mail in March and April 1985 and a major internal study conducted by the European Organization for Nuclear Research at Geneva.

2.3.2 In 1984 the Advisory Committee for the Co-ordination of Information Systems (ACCIS) in Geneva established a Technical Panel on Computer-Based Communication Services to examine the impact of new communication technologies on the transmission of information by UN Organizations and to explore the potential for establishing communication links between UN Offices worldwide. The Panel decided to conduct an experiment during February 1985 using existing communication links between UN Organizations or established links between commercial carriers. For a variety of reasons the experiment was delayed until April. Two major organizations - the International Labor Organization and the World Health Organization - chose not to participate because they already had developed the capability to transfer documents produced on an IBM PC to the International Computer Center's CALL/MAIL system.

2.3.3 At the conclusion of the project a working paper was prepared for ACCIS which reported its findings and offered a number of "suggestions." One obvious - but highly significant - finding is the need for a unified user language. The differences in procedures, commands, and user languages for gaining accessing to a network and actually using electronic mail services among the various organizations and systems are substantial and can only be addressed through standard protocols. Another finding notes that the most economical way to use electronic mail is first to prepare the document off the network (i.e., locally or stand alone) and then go on the network for actual transmission. Finally, the report noted that the "most regretable finding was that in certain cases where there were no impediments to participate in the experiment, no attempt was made to participate."

2.3.4 The report offers two principal suggestions. First, the ICC could play a critical role in electronic mail by becoming a central clearinghouse for all electronic messages. The ICC computer could support electronic mail boxes for all participants and collect and distribute electronic mail from different carriers and place it in the appropriate mailboxes. If this is done, then the ICC's CALL/MAIL system must be upgraded to provide services that are available through a commercial electronic mail system.

2.3.5 Perhaps the most noteworthy aspect of this experiment is that in personal interviews with archivists and records managers for organizations which participated in the experiment, only one records manager indicated any awareness of the experiment. This particular individual had been included in his organization's internal routing of correspondence regarding the experiment.

2.3.6 One of the more impressive and illuminating in-depth studies of electronic mail in a single organization was conducted by the Center for European Nuclear Research (CERN) in Geneva.

The study began in 1984 as an effort to address the problems involved in 1,200 people regularly using electronic mail to exchange up to 3,500 messages per day on systems that are only partially interconnected. In February 1985 the study was officially concluded with the release of a report entitled "Computer Based Message Systems Interconnection" (COMICS).

2.3.7 Although the report is quite technical, it nevertheless should be required reading for archivists and records managers since the problems and opportunities that CERN faces are in varying degrees the same ones other international organizations must address. Underlying the recommendations of the report is the adoption of an international standard for electronic mail, the CCITT X.400 Series of Recommendations for Message Handling Systems. This was influenced by the recognition that the majority of new developments are likely to be in the X.400 context and the X.400 has been designed to follow an upward technology migration path. Furthermore, as an international standard that conforms to the Open Systems Interconnect Reference Model, X.400 would allow user "transparent" communication between computers of different manufacturers and different networks.

2.3.8 The first recommendation of the COMICS study, therefore, calls for the adoption of the X.400 Series of Recommendations and related standards for electronic mail service as both a medium and long term objective. Specifically, this means that interfaces between existing electronic mail systems and the X.400 standard must be designed and that in the future only X.400 compatible Electronic Mail Systems should be installed. A second recommendation addressed generic requirements for an electronic mail system that would meet the interests and concerns of secretaries. Among the requirements are that the electronic mail system reach a large number of people, access to the system must be fast and simple, the command language should be English and possibly French, documents transferred from one network to another should retrain their format, and that recipients should be addressed by their names and not by their computer address. A third recommendation addressed the problem of X.400 based Directory Services or Name Servers that can with little delay relate the name of an individual to his mailbox.

2.3.9 The importance of computer network standards, especially X.400, and protocols for electronic communication can not be overstated. Information transfer among computer systems and communication entities is possible only if there are interface standards and protocols which will homogenize the vast differences that now exist and are likely to persist in commercial and government communication systems.

2.4.1 Related to the issue of standards and protocols is another area of considerable concern. While computer network standards and protocols ensure the reliable transfer of data, it is quite possible that the receiving system will not correctly interpret the data, especially when text processing is concerned. The reason for this is straightforward and easy to grasp. Documents (page images) in electronic form are composed of printed characters and control information, the latter including codes, formats, indentations, underlines, and other components that help shape a document. Since vendors design individual codes and formats to match the processing strength of the hardware and software operating systems, an inherent incompatibility exists between different software packages and systems. Compounding this difficulty is the fact that many vendors expand their word processing capabilities in order to maintain or expand a niche in the information market place. The net result of this that each vendor creates an island of its own conventions.

2.4.2 This inherent incompatibility that makes the electronic interchange of information very difficult can be illustrated in a variety of ways. Assume, for example, that you have a document produced on a personal computer using version 2.0 of Wordstar which has to be transferred to another personal computer which uses version 3.3 of WordPerfect. The control information Wordstar embeds in the document would be lost in a standard ASCII transfer, with the result that the person using WordPerfect would have to edit each line of the document and add appropriate formatting instructions. If it were necessary to transmit the document back to the originator, the WordPerfect version would have to be edited to fit the Wordstar system. This basic incompatibility of word processing packages makes it impossible to take full advantage of the power of electronic transfer of information. Complete electronic document mobility would mean that users would be able to transmit, revise, store, retrieve, and print a document without having to be concerned about system incompatibilities.

2.4.3. Several solutions have been advanced to solve this problem, ranging from purchase of a "black box" translator to limiting procurement of word processing systems to a single manufacturer. The effectiveness of the latter solution is limited to the area of control that can be extended over the procurement of word processing systems. Purchase of "translators" can become quite costly as provision must be made for more and more different word processing systems. On balance, neither solution is likely to be very effective.

2.4.4 One workable solution which is receiving considerable attention in the United States is what is called the Document Interchange Format (or DIF). Developed by the United States Navy and the National Bureau of Standards, DIF establishes a common format for 45 word processing control functions that with appropriate vendor-developed software would reformat word-processing files into DIF for interchange purposes. When a manufacturer provides a DIF capability, this means that a "filter" program developed by the manufacturer processes a document and translates the DIF control functions from their internal representations to DIF representations for export purposes. The "filter" program in effect permits conversion to and from the agreed upon "standard" and would practically eliminate the need to rekey word processing documents which must be read and processed by a computer system different from the originating system. There are certain control functions, footnotes, for example, that DIF does not address; consequently, footnotes generally would be lost. However, the important factor is that a standard for exchange of documents created by different word processing systems does exist and that manufacturers are incorporating it into their operating systems.

2.4.5 Another problem of equal concern is the incompatability of both data processing and text processing files created on one system but which at some point will be used on an entirely different system. A very desirable solution to this basic question of how to achieve both media and system independent files is the use of International Standard Organization 8211 Data Descriptive File for Information Interchange (DDF) which specifies a file or record format that allows data files to be easily transported from one computer system to another in such a way that there is no loss of content or meaning. The National Bureau of Standards in the United States, which has issued this international standard as a draft standard, recommends its use when a data base or a file is likely to be converted from one computer system to another and where the two systems are not compatible; when a data base or file is likely to be affected by an upward migration of systems from one technology to another; when a data base or file is likely to be used in information exchange and the two computer systems involved are not compatible; and when a data base or file "is intended for archival purposes and the format of access to a standardized structure is critical to guarantee long life availability and utilization of the data through standardized software support."

2.4.6 This standard is consistent with a format for archival information exchange used in the United States and Canada called MARC AMC, which was adopted in 1982. MARC is an acronym for Machine Readable Catalog and AMC stands for Archives and Manuscript Control. This format ensures adherence to a standard which in variety of hardware and software settings can ensure the relatively easy transfer of archival data bases and files from one operating system to an another.

Optical Disks

2.5.1 In late 1982 the U.S. Library of Congress initiated a three-year Optical Digital Pilot Program in order to evaluate the use of optical digital disk technology in dealing with preservation and management concerns for the Library's holdings and to identify the costs, benefits, strengths, and weaknesses of this technology in a production environment. A matter of some concern to senior management at the Library is the growing volume of its collections, now numbering 80,000,000 items and growing at a rate of 10 items per minute. Since the likelihood of building another adjacent Library building is remote, the potential high storage density of digital optical disks could provide a significant long-term solution to the never-ending need for additional storage space.

2.5.2 In 1983 the Library of Congress entered into a contract with Integrated Automation of Oakland, California, to design and build an experimental optical disk system. The hardware includes two 300 X 300 lines-per-inch raster scanners, one to scan 24X standard 98-frame microfiche frame by frame, and another capable of scanning material ranging from 4" X 7" to 11" X 14" books, charts, and printed material. This scanner can process a single page image in about two seconds. The system design required another critical component, a data compressor/expandor, to convert a binary black (1) and white (0) raster image to a compressed digital form for storage and conversely to reverse this process for visual display purposes. Four magnetic Winchester disk drives are required as an intermediate storage area for scanned images while they are awaiting a quality control review and for retrieval and display at user terminals. The optical disk drive, which Thomson CSF supplies, is a self-contained read/write unit that reads directly after writing on the disk (DRAW). Each disk which Thomson supplies is written only on one side and can store up to about 1 Gigabyte (or the equivalent of 15,000 images.) The heart of the hardware is an optical digital disk storage module, otherwise known as a jukebox, which will hold a maximum of 100 12 inch optical digital disks. The disks are located in storage cells arranged like a carousel, and systems software controls mechanical retrieval of the desired disk, mounts a selected disk, and after initiating the disk drive, finds the desired image and then using a lower power laser reads the document. Rounding out the system are two image-display terminals for input scanning and quality review functions, 6 public image-display terminals, and one Xerox 5700 laser printer.

2.5.3 All of the equipment and software were delivered and installed on schedule. Software that was designed by Integrated

Automation also was installed in November 1984. In January 1985 the operations scanning phase of the project began and will continue unto 1986.

2.5.4 The material to be scanned, converted to a digital image, and retrieved on demand cuts across a representative body of printed library materials, including periodicals, maps, microforms, manuscript and sheet music. It is estimated that the current hardware will support capturing 500,000 images per year. Initially, high-use current periodicals (e.g., the Congressional Research Service and articles and government documents dealing with public affairs topics) will be included in the 500,000 images per year.

2.5.5 A very important component in a system such as this is document preparation, a factor which frequently receives too little attention. In the Library of Congress Pilot Project document preparation involves creation of an index record, scanning, quality control review, and writing to optical disks. At the document preparation stage index information for each document to be scanned is entered by keyboarding. The system assigns a document number which links the index information to a specific optical disk location. A document then goes to a workstation where it is scanned and digitized at 300 lines-per-inch resolution. The digitized information is transferred to a magnetic disk for quality control review. If the image is satisfactory it is released to a laser writing process which actually records the signals on the surface of the optical disk.

2.5.6 Retrieval of a document can occur in one of two ways. First, if a user knows or remembers the document number, it is entered at a terminal. The computer system will link the document number to an image stored on a disk and instruct the jukebox to retrieve that disk. When the document number is not known, a search is made of the indexing terms to identify the appropriate document image on a disk and to instruct the jukebox to retrieve that disk. Once the disk is retrieved, the system displays high quality black-white images on the terminal monitor. Six user stations with high resolution monitors will be available to the public, along with a medium-speed printer.

Computer Assisted Retrieval of Microfilm

2.6.1 In the Federal Energy Regulatory Commission in Washington, D.C. an unusual integration of computer technology with micrographics and digital imaging technologies has led to a drastically improved records management program. In 1979 the Federal Energy Commission's files contained an estimated 40 million pages of official records with an additional 110,000 documents being received each year. The problems of dealing with this vast volume of material were exacerbated by some 40,000 requests each year for records. A central file system in which hard copy records were stored made it difficult to respond in a timely manner to requests. Many records were misfiled or lost with the result that requests for information sometimes were not answered for long periods of time. Because of this, some staff members began keeping copies of records which led to steadily increased need for storage space.

2.6.2 In 1980 an automated records management program was begun to provide rapid access to records, accurate retrieval of records, and reduction of the need for duplicate files. The system was designed and supplied by the TERRA Corporation and went into operation in April 1982. The system incorporates computerized document indexing, filming of documents on 16mm film, film storage in an automated retrieval system, and document output in either microfiche or hardcopy. Document flow proceeds along the following lines. Data entry operators enter cataloging data such as document type, name of the individual or organization, dates, and an abstract of the document (limited to 120 characters). From data entry documents are passed to the micrographics section where they are filmed on 16 mm blip encoded roll film. During the filming a microprocessor automatically captures the film location of each document and when a roll of film is completed the location information is automatically transferred to the catalog data base. Following film processing, several copies are made for backup purposes and one roll is placed in the storage and retrieval unit. This completes what is called the document preparation phase, which requires no more than 48 hour from receipt of a document until it is available for retrieval.

2.6.3 Retrieval involves having access to the index data base via remote terminals in different offices and buildings.
The index data base can be queried for a specific document when its number is known or for a set of documents which meet certain search criteria, such as author's name and date. In response to a query, the system displays the complete index data for each document. If a copy of the document is needed, a staff member enters this request at the terminal and this is transmitted to the image retrieval system and the request is filled automatically. The retrieval system identifies the appropriate roll of film and retrieves it with a high speed processor which unwinds the film until the first page image (noted by a blip code) is encountered. This page image and the rest of the document is scanned and converted to a digital bit stream which is sent to a high resolution printer or a COM unit. The printer is used if the document has fewer than ten pages. If the document output (one or more documents) exceeds ten pages, the output is a standard 24X microfiche. The last frame of the microfiche is an index frame which gives the frame location of each document.

2.6.4 Overall, this is an impressive system which has given the Federal Energy Regulatory Commission a level of document control that did not exist. For contemporary documents file integrity has been regained and timely access by both the public and staff members to official records is possible. As more and more retrospective document conversion is done, the system will become even more effective.

Artificial Intelligence

2.7.1 A major development in artificial intelligence research in the last few years is the design of computer-based knowledge systems which attempt to replicate human experience. Called expert systems, they attempt to incorporate the knowledge and experience of experts into a set of rules in the form of IF/THEN (premise/conclusion) from which a computer selects the best solution to a problem from a number of possibilities. Expert systems, in effect, attempt to solve problems that previously required human intelligence. The use of powerful microcomputers such as the IBM XT or AT has greatly expanded the range and number of applications of expert systems. Included in these applications are programs in business planning, banking, medical diagnoses, satellite engineering, nuclear engineering, and training, among others. Some microcomputer-based expert systems also include the capacity to weigh various hypothetical consequences of a decisions by following multiple lines of reasoning until enough evidence has been accumulated to believe that one set of assumptions is superior to another set.

2.7.2 Generally, an expert systems application is a cooperative effort of a knowledge engineer and an expert in a particular field. A knowledge engineer is a specialist in identifying and understanding the relevant thought processes of an expert in solving a particular problem or set of problems. On this basis a knowledge engineer helps an expert to structure relevant knowledge and identify the important concepts and rules that are used to solve problems. The domain expert is an individual with substantial knowledge and experience in solving problems in a particular field.

2.7.3 The only major archival application of a computer expert system is occurring in the U.S National Archives in the form of a prototype test being conducted by American Management Systems, INC. A primary goal of the project is to test if a rules-based system that stores implicit or explicit search rules that an archivist uses in responding to a reference request or to locate desired information can emulate the process that an expert archivist uses in locating that same information. The knowledge domain for the test is a group of documents from records of the Department of Interior which span most of the nineteenth century to the mid-twentieth century. The system itself uses what is called an M.1 software shell that runs on an IBM AT. In addition, the system employs a list of predetermined search paths and a list of items likely to be encountered in a search path. For example, the lists contain facts about the records to be searched, search topics, and search paths to information items which are heruistically connected with the search topics. The latter are particularly important since they constitute a logical model of the steps this expert archivist invokes in searching for desired information.

2.7.5 The system works in a very straightforward manner. First, it requests a user to enter one or more queries and then it responds with a list of general subject terms which users must assign a numerical weight that reflects the relevance of the term to the query. Each subject in turn has a list of possible relevant topics associated with it. Also included is a numerical value which reflects the domain expert's sense of the relative importance of the topics. The system combines the two numerical values and displays the five topics with the highest rankings. The second stage, which proceeds very rapidly, generates a list of records which may provide the desired information. At this point, the particular documents must be physically retrieved and an evaluation made of the relevance of the identified documentation to the original query.

2.7.6 This project will come to a conclusion in December 1985 and American Management Systems will prepare a full report. Preliminary results suggest that it would be feasible and useful to utilize an expert system in handling reference queries. It appears that another interesting possible use of the same knowledge base is computer-assisted instruction to train archivists unfamiliar with the records. Another very intriguing possible use of an expert system is in the process of assigning retention instructions for records before they come into the National Archives. This is a judgmental process involving the use of explicit and implicit knowledge-based rules which is very time consuming and seems to lend itself to being incorporated into an expert system. Overall, preliminary indications are that this is a technology with great potential application in archival work and records management.

Chapter Three

IMPLICATIONS AND OPPORTUNITIES

3.1.1. Records managers and archivists, to be successful in the electronic information age, must learn both how to implement the new technologies in their work environment and how to identify opportunities for implementation. The use of new information handling technologies has not led to the "paper-less office," and it is not likely to do so in the near future. On the contrary, the new information handling technologies have helped create situations in which there is more information to manage and keep track of because of the ease of electronic duplication. This is exacerbated by a multiplier effect resulting from multiple access to information that can be retrieved electronically. As electronic image and transfer technologies expand, opportunities to store, deliver, and share information will increase without any intervention on the part of an archivist or records manager. This presents both a challenge and an opportunity for archivists and records managers. The challenge is how to develop and implement retention and disposition policies and practices which do not place an undue burden on users and at the same time satisfy legal and institutional requirements regarding the use of information. An opportunity "window" is open to archivists and records managers to influence and help shape the implementation of these new information handling technologies.

3.1.2. The emphasis of this chapter is threefold. First, implications of trends and applications covered in the previous two chapters for the way archivists and records managers carry our their work are reviewed. This involves rethinking what records management means in an electronic environment. Second, opportunities are identified which will give archivists and records managers a vehicle for influencing the implementation of information handling technologies in international organizations. This discussion focuses upon electronic mail, office automation, and development of standards. Third, developing new ways of working with institutional policy makers that ensure full recognition of the importance and role of archivists and records managers in an electronic environment. Strategic planning and presentation of program suggestions fall under this heading.

IMPLICATIONS

3.2.1. Microcomputers, along with new data entry, storage, and transmission technologies, have extended the power of the computer far beyond the confines of the mainframe computer center. This technological explosion is having and will continue to have an enormous impact on the way organizations handle information, especially in terms of viewing information as a resource to be managed like any other resource.

3.2.2 One implication is the growth of information resource centers (IRC), which attempt to address the needs of an increasing number of users with access to computer power. In organizations where top management believes that the proper use of technology may improve operations, information resource centers are likely to promote widespread use of state-of-the-art hardware or software and to look for opportunities to introduce new systems. This proactive stance also involves monitoring technology, watching for trends or signals of a technology change that could affect the organizations operations. Information resource centers also are likely to be interested in overall organizational policy on microcomputer procurement and standardizing hardware and software. The latter are particularly important for electronic network considerations. Since information resource center staff and archivists and records managers share a common interest and concern about information-handling technologies, cooperation and support activities are a logical development.

3.2.3 A second implication is the increasing recognition of the need for carefully thought-out strategic plans for the use of electronic information handling technologies. Although there are exceptions, the general tendency in developing automation strategic plans - whether they involve the introduction of electronic mail, office automation, computing priorities, or guidelines for the use of microcomputers - has been to overlook records management and archives programs and activities. Part of this neglect can be attributed simply to the fact that many computer experts have little exposure to or appreciation of broad information management problems confronting organizations today. Part of this neglect also can be attributed to management inertia or conflicting priorities when financial resources are limited. Whatever the explanation, the failure to address the broad information requirements of records management and archives in automation strategic planning will inevitably result in decisions that make it very expensive, and perhaps impossible, at a later date to incorporate these requirements into automation plans, programs, and priorities. Short-sighted strategic planning may create insuperable technical obstacles or omissions that sharply circumscribe the systematic use of electronic information handling technologies in records management and archives.

3.2.4 Closely related to the growth of information resource centers and the introduction of flawed automation strategic planning is the expansion of end-user computing in which users control when and how microcomputers are used. End-user computing is by definition and practice decentralized and undermines a major portion of the rationale for traditional records management. Traditional records management emphasized economic benefits resulting from the unnecessary duplication of material, the use of standard forms, the speedy disposal of material of temporary value, and low cost storage for material of long-term value. Traditional records management also offered retrieval keys to documentation through its emphasis on file organization and indexing. Since many of the issues records management dealt with were closely related to archival concerns, the two activities were viewed as being mutually dependent.

3.2.5 Although this emphasis varies, depending upon the agency and national practice, it nonetheless points to a major problem electronic information handling technologies create for archives and records management. The tools of end-user computing - word processing, spread sheets, electronic mail, and data base management systems - help create a highly decentralized work environment that makes it very difficult, if not impossible, to support records management as it is generally practiced today. Low cost electronic storage of documentation likewise reduces the economic benefits of traditional records management. In addition, there seems to be little need for file organization and indexing expertise when word processing and data base management software can handle much of this with users scarcely being aware of it.

3.2.6 Perhaps the most profound ramification stemming from the introduction of new information handling technologies is what is generally called electronic mail. Frequently, electronic mail and telephone calls are viewed as informal office communications with the former being more convenient and efficient since a message cam be delivered even if the recipient is doing something else or is unavailable at the moment. A clear distinction, however, should be made between electronic mail messages and electronic mail documents.

3.2.7 Although electronic mail messages tend to be informal communications, they are far more than a convenient replacement for the telephone. Electronic mail messages in fact are a replacement for the informal communications common in most office settings. The short note written out on a note pad with little attention paid to form, or marginal comments on a letter or report are typical examples of informal communications which fall under the rubric of electronic mail messages. The focus is on the informal nature of the information content of messages. In contrast, electronic mail documents refer to formal communication in an office setting - a standard form, memo, letter, or report captured on paper.

3.2.8 Widespread use of electronic mail is inevitable and most surely will alter the traditional work environments in which clerical personnel and secretaries must know grammar, punctuation, syntax and be able to edit or proofread the documents they produce, usually in typed form. In addition, clerical personnel and secretaries draw upon their previous experience and or knowledge in determining who receives a copy of a given document and see to it that they are mailed and office copies are filed. The increasing use of microcomputers which are tied into a network will give managers and other professionals all of these tools. In effect, the centralization of traditional paper document processing will give way to a decentralized system in which document initiators will have the option to make all of these decisions. Most of these activities, however, with the possible exception of subject filing (non-numeric file codes) could be easily handled by the system.

3.2.9 Given this assessment, a prerequisite to defining non-traditional electronic records management is a conceptualization of the broad dimensions of records management. To proceed very far along the road of understanding and defining electronic records management requires a rethinking of what records management is all about.

3.2.10 A good beginning point is that records management is really another way of talking about information management, but with a twist. Records management, as it is traditionally understood, is an information management and control tool in which the focus is upon the management of the physical entity carrying the information. The information is captured on a carrier - a piece of paper, film, or the like - with some encoding device such as a typewriter. Once captured in this form, the information is frozen in time and context. Any changes in the information require changes in the carrier itself, thus repeating the initial information capture activity.

3.2.11 The control aspect of information management (read records management) comes into play through cost reductions of information capture, storage, and use. This involves what is called the life cycle of a record: creation, maintenance, and use. The creation phase involves the question of the need for the information itself and what use will be made of the information. The maintenance aspect of a record refers to the availability of the information when it is needed. Usually, this has involved formal systematic filing procedures that ensure speedy retrieval as well as cost-effective storage. Disposition, the last phase of the life cycle deals with what happens to the information after the initial purpose for which the information has been satisfied. In many instances, this means destruction since the information is of temporary value. In other instances, the information has some legal, financial, or historical value that mandates long-term preservation. Disposition obviously involves issues of concern to archivists.

3.2.12 The control pressure point typically is viewed as focusing upon the carrier of information: forms management, directive management, mail management, and correspondence management. Controlling the carrier of information permits control of information itself. Because paper has been the primary carrier of information for centuries, paper has become synonymous with record and document. Therefore, records management as an organized activity and function within an institution has concentrated upon paper-based documentation. Micrographics has added little to the conceptual basis of records management since it is an extension of paper-based documentation.

3.2.13 The universe of electronic records management is substantially different from that of paper-based records management. Information is captured electronically and stored on a physical storage medium. However, this information is not frozen in time and context since it can be erased, modified, and transmitted electronically with no change in the carrier itself. Thus, it is the information itself, and not the carrier, that is changed or destroyed. Electronic information is dynamic in that its constituent parts (sometimes called data elements) can be easily and rapidly rearranged, changed, manipulated, and merged or deleted on demand. Thus, information that is electronically captured and stored is generically different from paper-based information.

3.2.14 Another important consideration is that appraisal of paper-based documentation traditionally has occurred long after creation of the documentation itself. In some institutions appraisal occurs only after the material has been transferred to the archives. If any one thing is clear about electronic records management, it is unarguable that appraisal of records and identification of their retention period (however they are accomplished) must be done very early in the life cycle. Also, it seems quite likely that transfer of electronic documentation to archives will also occur much earlier than paper records simply because of the difficulty of providing proper control and care of electronic documentation.

3.2.15 In this context of appraisal and retention periods, electronics document management, whether it be in image or ASCII code, shares at least one important characteristic - documentary value or evidence - with traditional paper-based records management. The long-term value of information rests upon two considerations, which are not necessarily mutually exclusive: does the information constitute evidence of policy, program, financial, or legal decisions and activities; and can the information be used to illuminate broader aspects of an institution's activities as they relate to overall societal developments.

3.2.16 The approach of managing information through controlling its carrier (some physical form such as paper, film, or drawings) is not directly transferable to electronic based information. Electronic based information, which has been characterized as "processable information," requires a different approach. This different approach, at minimum, involves shifting the emphasis from control of "records" or physical storage media to control of the information or content which is electronically captured, stored, and retrieved. The critical issue for electronic records management, therefore, is to identify system pressure points which can be used for control purposes.

OPPORTUNITIES

3.3.1 There are at least three feasible system pressure points in electronic information handling systems - hardware, software, and telecommunications. Hardware refers to equipment procurement policy and practice that incorporate full systems user considerations and minimize the likelihood of hardware incompatibility and technology obsolescence problems. Full systems user considerations usually are derived from detailed analyses of information handling requirements. Hardware incompatibility problems can be quite diverse, since most computer manufacturers design hardware to maximize system strengths and give them a competitive edge. Typically, in a main frame computing environment it is very difficult to integrate two different computer systems into a single system. One way to reduce, if not eliminate, mainframe hardware compatibility issues is a requirement that any equipment procurement must specify certain vendor performance standards and the need for technology migration paths which assure that both old and new systems can be used. Another way to ensure that technology migration of data bases and processable text is possible is through adherence to ISO 8211. So far as microcomputers are concerned, material produced by 8-bit machines cannot be processed on 16-bit machines and double density drives cannot be read on single density drives. In the area of microcomputers applications a useful requirement would be that all diskettte drives record at a certain density (double density for instance) and that diskettes of a specified size (5 and 1/4 inch, for example) are used.

3.3.2 Software compatibility issues constitute the next level of pressure points. A basic consideration is to ensure that operating systems can communicate with each other. Most operating systems, especially those relating to word processing systems, are unique to a particular vendor and it is possible for two microcomputers to be compatible at the hardware level and yet be incompatible at a software level. For example, an operating system called MS-DOS runs on IBM compatible hardware but really is not compatible with any other non-IBM operating system. Selection of one operating system, such as MS-DOS, to be used on all microcomputers would make it easier for information to be shared by all users of stand-alone microcomputers.

Application software, such as word processing, data base management systems, and spread sheets, generally is vendor-specific and cannot be easily moved from one software application package to another. For example, documentation created on WordStar cannot be easily processed by WordPerfect, even though both might be running on IBM compatible systems. The Document Interchange Format makes it easy to physically exchange electronic documentation from one stand-alone word processor or microcomputer to another when incompatible software is being used. Requiring that any word processing package support DIF would ensure that this kind of software incompatibility would be avoided. A much less efficient way to handle this is to generate the electronic document in straight ASCII code and write it out on a diskette of or transmit it to another microcomputer via a modem.

3.3.3 Software compatibility becomes even more critical when it is necessary to exchange or pass electronic spreadsheet information, information in a data base management system, or processable text from one stand alone microcomputer to another or upload this information to a mini/main frame computer. Either the same software must be used by the originating system and the receiving system or there is a common data or text interchange format. Establishing a standard electronic spreadsheet and data base management system that is compatible with mini/main frame software is an effective way to minimize software incompatibility. The adoption and use of ISO 8211 is a very effective and relatively inexpensive way to achieve this same goal.

3.3.4 Although software compatibility issues for stand alone microcomputers constitute a significant problem, nevertheless it is a temporary one. The stand alone microcomputer in an office environment (as opposed to home use) will be displaced over the next five years or so by integrated office systems in which there are intelligent work stations that are part of a network and yet also can function as stand alone units when this is necessary, as, for example, while drafting a document. Thus the software capability of integrated office systems will become the most critical pressure or control point in electronic records management and archives programs. Archival and records management consideration, therefore, should be directed toward ensuring that the full potential of this pressure point is exploited. This means that in the short run traditional records management procedures would govern documentation created on stand alone word processors or microcomputers. To put this another way, word processing diskettes are a temporary problem (three to five years) best handled by dealing with paper output of textual material, not the electronic form. If exceptional circumstances make it necessary to get the document back into electronic form, it probably would be more cost-effective to use a low cost optical character reader, as long as a standard type font was used to print the document.

3.3.5 One way to deal with the pressure point of integrated office information software is to identify those archives and records management requirements which the software must meet. Several minimum requirements are: (1) automatic indexing of documents; (2) automatic assignment of retention/disposition instructions; (3) automatic creation of an archival data base; and (4) convenient electronic transfer of archival data bases from a network file server to central archives. Some integrated office information software now partially incorporates these requirements and could be further customized to incorporate all of the requirements.

3.3.6 Software that automatically indexes documents without requiring or precluding any effort on the part of the document originator or any one else is important, since it is not realistic to expect users to consistently do this. And consistent indexing is essential to any reliable information storage and retrieval system. One way to achieve reliable indexing is to combine minimal indexing with full text search and retrieval capability (as discussed in 1.6.7). This minimal indexing is associated with formal communications - memo, letter, or report. Typically, a memo has the date created, the originator, the recipient, and a general subject. An integrated office automation system could be easily customized to include each of these information items as index terms through a system default action.

In other words, merely entering date (or having the system supply it), originator's name, recipient's name, and general subject at the appropriate places on a screen would constitute indexing action. This indexing information could be supplemented by system supplied name of the originating office and recipient office. A document in draft stage would not require these index terms. However, once the document is ready to be communicated it becomes a formal communication and the system would not accept the document for communication until the information is supplied. Of course, many people will want to use an electronic information network for informal communications also. In most office settings informal communications - short notes without regard for form - have no evidential value and little, if any, informational value. Consequently, it makes little sense to index informal communications. This could be handled by declaring that all communications longer than, say 100 characters, are by definition formal communications and must be written in a prescribed manner (e.g., date, name and office of the originator, name and office of recipient, and general subject for a memorandum).

3.3.7 Minimal assignment of indexing terms, even automatically, makes sense only if a full text search and retrieval system based upon parallel processors is available. In such a system, search queries could be made which combine date, name of recipient or originator, or any desired combination of user supplied retrieval terms. Such queries could be executed very rapidly and also provide almost instantaneous retrieval of desired documents. This approach offers several long-term retrieval advantages which will be reviewed in a later discussion of archival transfer.

3.3.8 The second requirement for an integrated office automation system is automatic assignment of retention/disposition instructions. Automatic assignment of retention/disposition instructions is important for two reasons: it is not realistic to expect the originators of electronic documents to uniformly assign the appropriate retention instructions they create; and it probably would not be cost effective to have someone review all electronic documents and then assign the appropriate retention instructions. Of course, provision must be made for originators and recipients of electronic documents to change incorrectly assigned retention instructions. Usually, there is little question about those records which are disposable and those which are of permanent value. Some records, especially a newly established series, can not be easily categorized as either disposable or permanent and provision must be made for the system to accept this and permit review of the material at a subsequent date for a final determination.

3.3.9 Automatic assignment of retention instructions involves some form of an artificial intelligence application. The simplest form would be to incorporate the office filing plan along with the appropriate retention instruction attached to each entry into the integrated office information software. User identification of which item in the filing plan a particular document falls under would invoke a system instruction to assign that instruction to the document. This approach presumes that a filing plan exists, that it is used, and that retention instructions have been established for each entry in the filing plan. If these circumstances are not present, the automatic assignment of retention instructions becomes much more complex and difficult.

3.3.10 There is the possibility that one form of artificial intelligence - the use of expert systems - may help solve the problem. As indicated above, expert systems involve formalizing the experience and knowledge of an expert into a set of deductive rules which are converted into a computer program. This program displays a series of questions on a monitor which generally require yes/no responses. Based upon these yes/no responses, the computer reaches the appropriate conclusion. Usually, records retention rules (combination of an individual's experience and knowledge and a set of regulations) comprise a finite body of information which appear to be susceptible to use in an expert system. Although most artificial intelligence applications in the past have involved mainframe computers, expert systems are available for use on a fairly powerful microcomputers such as the IBM XT or AT. This suggests, among other things, that expert systems might be able to customize records retention instructions to reflect the program activities of particular offices. Although no effort thus far has been made to conduct a pilot project to test the feasibility of using a microcomputer based expert system to guide the assignment of retention instructions, this is an area which certainly offers great potential. Given the time window discussed earlier, there is time to carefully test this approach and if it is successful to have the software incorporated into integrated office information systems.

3.3.11 Automatic creation of an archival data base - the third requirement for integrated office systems - simply carries retention instructions to their logical conclusion. In paper based records management systems it is axiomatic that files of archival value and those of temporary value are segregated and not interspersed. Physical segregation of electronic documentation in terms of archival value and temporary value is far less crucial since each document has an assigned retention instruction and the computer keeps track of where each document is stored and when it can be purged, if at all. Over time as records of temporary value and there associated index terms are automatically deleted from the system, an archival data base will be created which will consist of electronic documents, the system assigned index terms, and retention instructions. The key factor here is that no human intervention is required for an archival data base to be created. Of course, the system should permit an archival data base administrator to make changes as they are necessary.

3.3.12 In the long run the most important requirement for an office information system is the capacity to conveniently transfer an electronic archival data base from a file server to a central archives. If both the integrated office system and the central archives use compatible storage and retrieval software, the transfer could be as simple as copying the data base on the file server to a magnetic tape for transfer to the computer the central archives uses. Equally as simple would be a direct file transfer of the data base on the file server via a network to disks on the computer the central archives uses. If the integrated office system and the central archives use different information storage and retrieval software, transfer still can be easily accomplished if the file or data base initially was created in accordance with the specifications of ISO 8211. If ISO 8211 was not followed, file transfer can become very complex and difficult. A special file conversion program must be written that translates the document format control field (index terms and body of the document) used by the file server into a format that will be understood by the central computer system. If a file conversion program is not written, the data base still could be transferred using the ASCII output mode which the integrated office system software should have. The problem with this kind of data transfer is that the control characters identifying index terms used on the file server will be stripped off and access to archival files will be very difficult if full text searching is not available.

3.3.13 This discussion of incorporating records management and archival requirements into integrated office systems highlights a much larger problem - the development of standards for hardware and software procurement and communications with individuals and institutions outside the agency or institution. The latter involves telecommunication and network considerations which now are the focus of international discussion, especially OSI (Open System Interface). The salient factor is that telecommunication and network standards are being developed which should take into account electronic archival and records management concerns. If this does not occur, then vendors likely will develop communication protocols that do not easily support records management and archival requirements. This underscores the importance of records managers and archivists taking a proactive stance in calling attention to these matters and becoming involved in automated planning.

PLANNING

3.4.1. At the outset, it is important to recognize that the introduction of new information handling technologies (or, as some might characterize it, an "electronic wand") can not cure basic information handling problems. A fundamental prerequisite, therefore, is that manual systems must be properly organized, efficient, and effective. Overlaying new information handling technologies on existing manual systems without first ensuring that the manual system is operating smoothly and meeting management objectives is to invite failure and disappointment. Introducing automation for the sake of automation without careful attention to defining information handling requirements is a guaranteed formula for an automation project that will be an embarrassing failure.

3.4.2. The first step in this evaluation is the development of a logical model of the existing system. This requires an examination of every aspect of the work system, including the nature of work each person performs, the movement of work, the forms (if any) being used, standards that are applied, timing requirements, and identification of any problems. Understanding this logical model is greatly facilitated if it is presented in a flow chart.

3.4.3 After this logical model has been constructed and charted, it is possible to evaluate critically each component in the manual system. This evaluation involves analysis of each step or aspect of the system, including existing problems, and identification and explanation of proposed solutions. A new work flow reflecting implementation of these solutions is incorporated into a new model. Frequently, unanticipated significant findings may emerge from the revised logical model which highlight concerns of interest to top management. These concerns can be used in presenting an implementation plan to management.

3.4.4. Development of an implementation plan should not be linked to matters that are not relevant to management. Introduction of new information technologies for their own sake usually is not relevant in most organizations. Organizational needs and not technology needs should be emphasized. This means identifying the key problems in an organization and looking at the amount of time devoted to their solution. Some specialists in organizations studies argue that key problems in organizations generally are only about 20 percent of the work flow but their solutions require about 80 percent of available staff time. Identifying those key problems which are real time consumers is a major step toward dealing matters which are real issues to management.

3.4.5 The critical issue for records managers and archivists is to link a records management/archives solution to real issues for management. A general beginning point would be to become familiar with studies that have examined automation planning in international organizations. One such study that is relevant to this discussion is Earl Sohn's "The Changing Use of Computers in Organizations of the United Nations System in Geneva: Management Issues." This study examines all aspects of automation, including records management and archives, and calls attention to the importance of bringing records management and archives under the umbrella of automation planning. Another critical area is the development of computer-based telecommunications that can significantly reduce the cost of communications. Although no overall study of this important topic in international organizations has been undertaken, it clearly is another area which can be linked to archives and records management.

3.4.6 A general awareness of specialized automation studies that deal with issues relevant to international organizations along with a fundamental understanding of the way information is handled in an institution can provide a springboard that can carry archival and records management programs into strategic planning. The critical area is that of defining the information handling problem areas within an organization and relating them to archival and records management concerns. In this regard, the concept of the life cycle of electronic documentation, discussed earlier in this chapter, can be very useful, especially in terms of demonstrating the increased productivity and efficiency that are possible. In the final analysis, this means that archivists and records managers must understand and accept the larger role they can play in the information handling arena in their organizations. Without this fundamental commitment, it is not likely that archivists and records managers will be able to influence strategic automation planning.

Chapter Four

STATUS OF ELECTRONIC RECORDS MANAGEMENT AND ARCHIVES IN INTERNATIONAL ORGANIZATIONS

Introduction

4.1 In the background and planning work which led to this study a major goal was to collect information on the status of electronic records management and archives in international organizations. Without reliable information on this issue, it would be difficult to establish the institutional context in which to assess progress being made in this area as well as to provide the framework for study recommendations. Consequently, chapter five reports the results of a survey of international organizations. In this regard, therefore, chapter four is a bridge between the conclusions of chapters one, two, and three and the recommendations in chapter five.

Questionnaire Design

4.2.1 The study plan underlying this report called for a carefully designed questionnaire to collect factual information and capture attitudes about electronic records management. A draft questionnaire was developed that included questions relating to the authority archivists and records managers had over machine-readable information, the extent of automation, (including mainframe processing, microcomputers, and office automation), automation of a central registry, and correspondence tracking systems. Other information was collected about the size and type of organization in the expectation that this would possibly help identify institutional characteristics that account for certain trends. The questionnaire was divided into a main body, which contained 55 questions, and three supplements. The three supplements dealt with processing administrative data on a large mainframe or minicomputer, transactional data on a large mainframe or minicomputer, and electronic mail systems, and were intended to solicit detailed information about each application area.

4.2.2 The draft questionnaire was then given to Ms. Gertrude Long of the International Monetary Fund and Dr. Frank B.Evans of the National Archives and Records Administration, both of whom have wide experience in international organizations, for their views. In addition, three colleagues with wide archival experience were asked to complete the questionnaire as a pretest. Based upon comments and suggestions from these individuals, the questionnaire was revised to eliminate some ambiguities.

4.2.3 The survey plan called for distributing the questionnaire to thirty-four international organizations suggested by SAIO. This was to be followed up with on-site interviews in those responding organizations where supplemental information could be obtained. Questionnaires were mailed out in late May with the request that they be filled out and promptly returned since on-site interviews would be scheduled in early August. Eighteen responses were received and follow-up interviews were scheduled with nine archivists and/or records managers. The following discussion of survey findings is based upon the filled-out questionnaires and personal interviews.

GENERAL COMMENTS

4.3.1 In addition to the eighteen filled out questionnaires, three very revealing letters were received. The author of one letter after noting that the only electronic device used in the records management service was a word processor and that the Records and Archives Unit has no "authority over machine-readable records or electronic records in use in various segments of the Organization," concluded that no useful purpose would be served by filling out the questionnaire. A second respondent stated that "... we have no information relevant to the study you are undertaking, as no computerized system of records management or archiving is being used ...." The third letter was much more helpful, and in many ways, reflects a major obstacle to electronic records management and archives in international organizations. The writer of this letter observed that since the organization has no registry and there is no central records management program, filling out the questionnaire might give rise to misleading conclusions. Subsequently, the author of this letter was interviewed in person and provided very useful information, especially with regard to electronic mail.

4.3.2 The first five questions were designed to elicit general organizational information - size of organization, number of employees, and branch offices - that might be useful in identifying trends based upon organizational characteristics. Although there was considerable range in organizational characteristics, the only noteworthy observation is that five of the eighteen respondents were from organizations not affiliated with the United Nations. Generally, three of these eighteen organizations - the International Monetary Fund, the World Bank, and the InterAmerican Development Bank - tended to be further along in understanding and dealing with problems in electronic records management and archives, especially with regard to applying the life cycle concept of information and establishing central records management.

Records Management Responsibilties

4.4.1 Thirteen respondents reported having records management responsibilities; five replied that they have no such authority. Every organization which reported any records management responsibility said that this included files maintenance and appraisal for archival value. Most respondents had authority over correspondence management (11 respondents), mail management (9 respondents), records scheduling (12 respondents), and vital records (10 respondents). Authority over forms management (4 respondents), directives management (1 respondent), reports management (3 respondents), micrographics (6 respondents), and clerical work management (3 respondents) apparently has a very low priority. In addition, no organization claimed authority for approval of publications, electronic publishing, or source data automation.

4.4.2 In response to the question whether they have records management responsibility for machine-readable materials, the five respondents who had previously replied that they did not have any records management responsibility were joined by eight others who acknowledged they too had no authority over machine-readable records. And of the remaining five who answered "yes" to this question, subsequent discussion clarified that only three of them had explicit authority over machine-readable records. Thus, only three of the respondents (16%) have stipulated responsibility for electronic materials. In the absence of records management responsibility of the archives for electronic records, either the computer center exercised control over electronic records or the responsibility was not clearly defined.

4.4.3 The question of whether or not respondents are routinely consulted on records management issues relating to automated information systems elicited a response pattern similar to the one just discussed. Respondents from the three organizations having explicit authority over machine-readable records reported that they were routinely consulted on records management issues related to machine-readable records. The respondent from a fourth organization, who reported that the responsibility for machine-readable records was not explicitly defined, noted that the records management section was routinely consulted on records management issues dealing with machine-readable records. The three organizations whose records management responsibilities extended to electronic information systems also said they were routinely consulted. All others reported that they were not routinely consulted. It should be noted that two other orgnizations soon will issue policy statements assigning this responsibility to the archives and records management section or will initiate a pilot project. Nevertheless, the overwhelming conclusion is that most international organizations lack clearly designated record management authority for machine-readable records. Since most international organizations have been generating machine-readable records for at least a decade or more, this clearly is not a recent development and suggests that it will be very difficult for international organizations to address the more difficult contemporary issues and problems of electronic records management and archives.

Extent of Automation

4.5.1 This deficiency in records management authority becomes even more evident in light of the extent of automation in international organizations. Every organization responding to the questionnaire reported having at least one in-house large mainframe computer. Nearly all reported using mainframe or minicomputers in financial applications (18 respondents), general housekeeping applications (15 respondents), personnel systems (16 respondents), and statistical data bases for reports (15 respondents). Just under half of the organizations use in-house main frame or minicomputers to track correspondence (6 respondents), to index correspondence (6 respondents), to control space for records (6 respondents), and to transmit document facsimiles (8 respondents).

4.5.2 Automated record management applications using either main frame computers or microcomputers also were highlighted in responses to the questionnaire. Eleven international organizations reported using main frame applications. Among the applications identified were computer-assisted retrieval of documents, creation of finding aids, and controlling vital records. The single most cited application was indexing - whether records, technical publications, or directives. While no organization reported having explicit microcomputer records management applications, two respondents who reported using mainframe records management applications also reported using microprocessors in records management.

4.5.3 All but three organization reported the use of microprocessors in one or more program areas. The most common application was word processing, closely followed by off-the-shelf software for microprocessors -- spreadsheets, data base management systems, and integrated software. Twelve of the seventeen organizations with microprocessors reported that the institutions' personal computers had communications capability. Eight organizations also reported that data could be downloaded from centralized collections to a personal computer for statistical analysis; eight also reported exchanging drafts of textual documents for additional text processing.

4.5.4 A key question in the questionnaire asked about the existence of written guidelines to assist users in determining the disposition of the data or documents which the microcomputers either received or processed. However, no organization reported that it had such guidelines. The absence of such disposition guidelines or some other solution governing the disposition of electronic records in international organizations clearly is an area that requires corrective action. It should be noted that one organization recognized that its draft Word Processing Policy Guidelines did not address the issue of "archiving of word processing discs." A 1985 management report from this same organization recommended that the "Registry study the need and feasibility of setting up a central archiving system for texts stored in the magnetic media, including the word processing discs."

4.5.5 This deficiency, it should be noted, is organizational in nature and does not reflect the real interest of archivists and records managers in international organization. A series of questions regarding respondents actually using a microcomputer or their interest in doing so in their day-to-day work identified an area of significant potential growth. Respondents from two organizations - only one of which is connected with the United Nations - reported using a microcomputer between one and three hours daily. Although two respondents reported no interest in personal use of a microcomputer in their daily work, eight did so. Their interest included word processing, statistical analysis, correspondence tracking, project management, and finding aid preparation.

Automated Central Registry

4.6.1 The questions which dealt with an automated central registry, elicited six responses from organizations reporting automation of a central registry using a large mainframe. Or half used commercial software (ADABAS or IBM INQUIRE), and one half use software - ISIS - which was developed by UNESCO. These automated central registry systems seemingly mimic manual systems in several ways. First, five of the six systems use the terms in the thesaurus of the manual system. Either the records management staff or the indexing staff indexes the individual documents as one would expect in a manual registry. Finally, the records management unit had primary responsibility for designing three of the six systems because the systems were internal to the records management organization. For the remaining three systems, the records management staff was consulted during the design of the system and assisted in developing the plans.

4.6.2 In terms of disposition, only one respondent reported that both the index and the records were of archival value. In two other cases, the index has been appraised as having archival value but the records are not. Portions of a central registry index have been transferred to two archives. In both cases, the central registry index is cut off after a certain period of time (usually five years) and transferred to the archives in human readable form. In these two organizations there are no plans to receive an electronic central registry index. In the other case, the archives has received the index in both human-readable and machine-readable form. It has not been determined what will be the future format of transfer. The disposition for the automated index and the records of the other three central registries has not yet been determined.

4.6.3 Responses (as well as non-responses) to this series of questions regarding an automated central registry in international organizations underscore several important findings about the use of automation in such organizations. First, only about one-third of the organizations have a centralized registry system. Where registry systems as well as records management are decentralized, it will be very difficult to implement a comprehensive and systematic automated registry system. Second, disposition instructions which do not require retention of the automated index and permit breaking a human-readable version of the index into five year time segments will create enormous long term retrieval problems. The net result of this kind of disposition instruction is to tear down an integrated electronic index into a series of time segmented (say, five years) indexes. These responses suggest that this is another major problem area for archivists and records managers in international organizations.

Automated Correspondence Tracking Systems or Indexing Systems

4.7.1 Seven questions addressed the issue of automated correspondence tracking systems. Only five respondents reported that their organization had at least one automated correspondence tracking system. Not unexpectedly, their responses about system design and operation indicate that there is not yet in place a uniform approach. For example, the five respondents had four answers to the question of who indexes the documents: the indexing staff (one respondent), record creators (one respondent), the computer center staff (one respondent), and the records management staff (two respondents). Four of the five automated systems were designed around the requirements of an existing manual system. The design of the fifth automated system, according to the respondent, forced a complete reexamination of the manual system.

4.7.2 On the question of whether or not the automated index has the same disposition as the associated records, there were two negative and two positive responses. The fifth organization reported that the index was an ongoing data base with no disposition.

4.7.3 The question of who determines the disposition of the records evoked a mixed response. One respondent said that the program office assigned the disposition, another answered the computer center, the third replied the records management staff, and two indicated the organizations' archivist. In response to the question about the archival value of the index, three organizations reported that this had not been determined, a fourth said "yes", and a fifth "no".

4.7.4 Although these widely divergent responses reflect the views of respondents from only five organizations, nevertheless they suggest that this is another problem area in archives and records management in international organizations which will worsen over time. The problem is not who indexes the documents but rather what is the disposition of both the electronic index and the documents themselves and who determines this disposition. What is required is the development of standards and procedures which clearly assign disposition responsibility to archivists and records managers.

Electronic Messaging Systems

4.8.1 The survey collected information on electronic messaging systems in five organizations. This set of 17 questions presumed that organizations with numerous geographical locations were more likely to implement an electronic messaging system than an organization with only one or two locations. However, based upon a comparative analysis of the five organizations which responded to this set of questions, there was no correlation between the number of geographical locations and presence of electronic mail service. Two of the four organizations with electronic mail systems had the fewest number of installations among all the respondents.

4.8.2 If there is any pattern at all to the responses to this supplemental questionnaire it is that those international organizations in which electronic mail is utilized have not addressed fundamental information management questions about this form of communication. First, no organization has determined the disposition of the electronic messages or provides information management guidelines to individual users of electronic mail systems. In two cases, the organization has not yet determined who will make these critical disposition decisions. Yet one of those organizations reported that a systems program routinely erases messages from the system. Closely related to this is the fact that all five respondents who reported some form of electronic mail did not answer the question about when the disposition would be determined for individual electronically stored documents. Since this question involved documentation life cycle considerations, these responses suggest there may be very little, if any at all, awareness of the importance of establishing the disposition of electronic records as soon after creation as possible. Second, paralleling this is the important question of whether or not the information will be transferred in electronic or human-readable form. The fact that none of the five respondents reported that this issue was being considered simply compounds the lack of awareness of the potential problems electronic mail now creates for international organizations. Responses to this supplemental questionnaire suggest that the basic management and archival questions about electronic mail in international organizations remain largely unasked and thus unanswered.

SUMMARY

4.9.1 The goal of this survey was to ascertain the status of electronic records management and archives applications in international organizations. An analysis of responses to a questionnaire and personal interviews indicate that with few exceptions most records management programs and archives in these organizations have not yet moved into the electronic information age, even though the organizations themselves have access to a very powerful computer capability. Where automation has been introduced it typically consists of an automated overlay on paper-based records management systems. Virtually no attention has been paid to the consequences of an inevitable increasing use of computers that will initially duplicate and eventually displace most paper-based information systems.

4.9.2 Underlying the electronic information problems in international organizations are four crucial difficulties. First, most international organizations do not have a centralized records management program. Even registries in many organizations are decentralized, with the central registry concentrating upon correspondence relating to top management policy and program decisions. Second, machine-readable records simply do not fall within the records management purview of most international organizations. It is difficult to see how the more complex and difficult information management problems resulting from the introduction of new information handling technologies can be dealt with when the problems of machine-readable records, which are comparatively easier to resolve, are not being addressed. Third, with few exceptions it appears that automation planners and policy makers in international organizations have not taken into account fundamental organizational information needs as they relate to records management and archives. Fourth, even if top management understood and appreciated these information needs, it is likely that limited financial resources and other priorities would severely limit a systematic and comprehensive introduction of new information handling technologies into records management and archives programs.

4.9.3 This less than optimistic assessment must be balanced by two important considerations. There are at least two United Nations organizations whose automation planners, archivists, and records managers understand clearly the potential information crisis their organizations confront and are working together in identifying the need for new policies, procedures, and standards. Over the next several years both organizations have the potential to develop electronic documentation programs which could serve as models to other international organizations. The second important consideration is the interest of most archivists and records managers in acquiring hands-on experience in working with microcomputers. This clearly identified need for and interest in information and training in microcomputer applications in archives and records management programs in international organizations can provide the base for an automation infrastructure in international organizations which would support and expand applications in archives and records management programs.

Chapter Five

Recommendations and Guidelines

The focus of this chapter is a series of recommendations which explicitly integrate the findings discussed in chapter four with the trends, applications, opportunities identified in chapters one through three. Although this is a somewhat narrow focus, nonetheless, many of the recommendations are relevant and generalizable to any institutional setting in which there is an awareness and concern about the ways that electronic information handling technologies affect traditional information handling activities, especially records management and archives.

Section of Archivists of International Organizations

5.1 The Section of Archivists of International Organizations (SIO) should take note of and officially endorse the recently completed study of "The Changing Use of Computers in Organizations of the United Nations System in Geneva: Management Issues." This study acknowledges the importance of records management and archives in the rapidly expanding applications of electronic information handling technologies, especially in UN organizations in Geneva. (The latter should not detract from its relevance to non-UN organizations.) Official recognition of the usefulness of this study by archivists and records managers in international organizations would lend the study greater credibility and reinforce efforts now underway to establish clear communication among the various participants in the use of electronic information handling technologies.

5.1.2 Related to this is the urgent need for SIO to call upon archivists and records managers in international organizations to take a proactive stance by bringing to the attention of top management the importance of archives and records management in the rapidly expanding area of electronic record keeping activities. Such a call should acknowledge that in most institutional settings, the success of archivists and records managers in becoming involved in helping influence automation strategic planning and implementation relates directly to the extent to which they seize opportunities to redefine archives and record management as a significant part of electronic information handling activities.

5.1.3 Another area in which SIO could set an important precedent is to formally establish liaison with the Automation Committee of the International Council on Archives in order to ensure full exchange of viewpoints and concerns. Such a cooperative endeavor could help the Automation Committee better identify special needs that it could address and at the same time provide the SIO with access to archivists who have considerable knowledge of automation developments.

5.1.4 Of equal importance is the need for the SIO to establish a formal liaison with the Advisory Committee for the Co-ordination of Information Systems, which is located in Geneva, Switzerland. Although this committee, which is better known as ACCIS, primarily serves specialized UN organizations, both its agenda and scope of activities address issues and concerns that are relevant to archivists and records managers. Participation in the ACCIS meetings and activities would demonstrate a proactive stance of the SIO and facilitate a full exchange of views.

5.1.5 As this study has noted, it is very important for archivists and records managers in international organizations to become fully informed about existing international and national standards governing the use of computer data bases and telecommunications and to call for their implementation in archival and records management applications. Specifically, the SIO should endorse the use of ISO 8211 and X.400 in archival and records management applications and urge members to work for their implementation in their respective organizations. Furthermore, the SIO should work closely with the Secretary for Standardization of the International Council on Archives to ensure that issues of concern to archivists and records managers are brought to the attention of working groups and organizations in the standards development arena.

5.1.6 A fundamental electronic archives and records management issue this study identifies is the need for specific assignment of disposition responsibility for information in electronic form, adoption of the life cycle concept of information, and early identification (or appraisal) of information in electronic form that has permanent value. The clear absence of disposition guidelines for electronic information (including machine-readable records) in most international organizations which responded to the questionnaire means that no archival or records management control is in place. Until this issue is addressed and resolved, there is little likelihood that any significant progress can be made in dealing with more complex electronic information handling technologies (e.g. electronic mail or microcomputers). Closely related to this is the urgent need to adopt the life cycle concept as the only feasible approach that helps ensure that documentation of permanent value in electronic form will in fact be retained and transferred to archives. For these reasons, it is imperative that the SIO endorse the centralized disposition of all information in electronic form and use of the life cycle concept (including early appraisal or identification of archival value) in archives and records management programs.

5.1.7 This study also notes that strategic systems planning should be an important activity for those archivists and records managers who are successful in dealing with electronic information handling technology issues. Unfortunately, since few archivists or records managers possess strategic systems planning skills or experience, considerable guidance in this area is required. One way to do this is by example. The leadership of SIO should undertake a strategic systems planning approach in terms of what the organization needs to do over the next five years in order to move the organization into the mainstream of electronic information handling applications. This assumes that clear goals will be defined and an incremental action plan with specific objectives and activities will be developed. The development of a model Five Year Plan for Electronic Information Activities would serve at least three purposes. First, the model would give SIO members who participate in the planning process some sense of what strategic systems planning involves. Second, the model would assist the SIO in identifying priorities and monitoring accomplishments. Third, the model would be a clear signal to other electronic information handling disciplines that archivists and records managers understand contemporary analytical processes and know how to use them to influence strategic systems planning and the resultant implementation of electronic information handling technologies.

5.1.8 An integral part of such a strategic systems plan is meeting the training needs SIO members and other archivists and records managers. The questionnaire analysis in chapter four clearly reveals that many archivists and records managers are very interested in obtaining training in the use of new electronic information technologies, especially with regard to the use of microcomputers. A carefully designed training program done, perhaps, in conjunction with the Automation Committee, that is part of a five year plan would go a long way toward building a technically informed infrastructure that is so essential to the long term effective use of electronic information technologies. Among the training priorities that merit attention are the archival and records management use of data base management systems, archival and records management requirements for electronic mail systems, and the establishment of a microcomputer based system to support archives and records management program goals and activities, including, but not limited to, finding aids and statistical reports.

Archivists and Records Managers

5.2 All of the recommendations relating to the SIO are equally relevant to individual archivists and records managers without regard to whether or not the institutional setting is an international organization. Consequently, this section restates many of the earlier recommendations for implementation in a variety of institutional settings where electronic information handling technologies are now in place or still in the planning stage.

5.2.1 One of the single most important activities that archivists and records managers who are concerned about the impact of electronic information handling technologies on archives and records management programs and activities can initiate is a change in outlook. By tradition and the nature of their work, most archivists and records managers tend to be reactive to problems and that result from changes in procedure and process rather than anticipating these changes and trying to shape them so that they also serve archival and records management ends. Therefore, it is of the utmost importance that archivists and records managers begin immediately to get involved in helping influence automation strategic planning and implementation activities. One very effective way to do this is by preparing and circulating a background paper to senior management officials which redefines archives and records management as a significant part of an institution's electronic information handling activities. If such activities are not in place, then the background paper can serve as input into a planning document for the introduction of electronic information handling technologies.

5.2.2 Related to the preparation of a background paper is the need to be informed about activities of the Automation Committee of the ICA and ACCIS. The latter can be easily accomplished by getting on the ACCIS Newsletter mailing list by sending your name and address to the Editor, ACCIS Newsletter, ACCIS Secretariat, Palais des Nations, 1211 Geneva 10, Switzerland. The ACCIS Newsletter, which is published bi-monthly and is available at no cost, contains useful summary reports on information technology and the work of various technical panels, among others. The Automation Committee publishes the ADPA Bulletin, which is an annual publication that reviews archival automation applications, and holds an annual meeting. Information about the Bulletin and annual meetings can be obtained from Mr. Wolf Buchmann, Bundesarchiv, Am Wollershof 12, D 5400 Koblenz 1, FRG.

5.2.3 Individual archivists and records managers can greatly assist in encouraging the widespread use of ISO 8211 and X.400 by determining if institutional or agency computer operations permit or require the use of either standard. Since both standards are relatively new (actually X.400 has not been formally adopted yet), it is likely that only a few managers of computer operations will know about them. Sharing this information and offering to assist in their implementation could bring greater cooperation among the various participants in electronic information handling technology applications.

5.2.4 At the institutional or agency working level there is no reason why archivists and records managers on their own initiative could not develop a strategic systems plan for automating archives and records management activities. Such a plan would address functional information requirements for archives and records management functions, describe goals, objectives, and activities, and in general lay out an action plan covering several years. A plan on this order quite likely would incorporate microcomputers as well as linkage with whatever computer capability exists for the institution or agency. Where feasible, this plan should tie in directly to the background paper discussed earlier in 5.2.1.

5.2.5 Since few archivists or records managemers have the background or experience in electronic information handling technologies, there is an obvious need for training. Some archivists and records managers can benefit from self-training obtained through reading appropriate literature. Others can best benefit from formal training such as short seminars and symposia or academic course work. Usually, a combination of self-training and formal training works for most people and probably would be adequate for archivists and records managers. Unfortunately, there is no single journal article, book, or short course that addresses the full range of training needs for archivists and records managers. Consequently, it would be advisable to consult with computer operations staff regarding recommended articles, books, and short courses. In some instances, computer operations staff might teach a short course on a particular topic. However, in most instances it is likely that the best training in this area will be offered by people who have a sound understanding of both archives and records management activities and electronic information handling technologies. Literature, which identifies opportunities for training in electronic information handling technologies, especially in North

America, generally is widely available.

Summary

5.3 The final summary recommendation calls attention to the potential for embarrassing and very expensive failure in the implementation of electronic information handling technologies where a careful analysis of systems requirements has not been conducted. Overlaying an automated systems solution onto flawed and inadequate manual processes is counter productive. This is even more true where the manual processes are fragmented and not clearly understood or followed. In situations like this or where little or no automation now exists, a far more useful approach to take is to identify a manageable activity and do a prototype systems study with the clear expectation that a microcomputer-based solution is intended. This approach involves a relatively low risk (financial cost and failure) and has the added advantage of providing staff members with hands on automation experience. This experience then can become the foundation on which more elaborate electronic information handling applications can be developed.

ANNEX 1

GLOSSARY

Access speed The amount of time, usually measured in milliseconds, that it takes a magnetic head to locate data in a subsystem (disk). Access speed is particularly important when a user is searching for small records scattered across a disk. (See transfer rate)

Access time This refers to the amount of time it takes to read or write at a storage location. Random access time means that each storage location requires the same amount of time to complete a read or write operation.

Applications program A generalized computer program which can be easily adapted to a specific need by changing specified parameters. Electronic spreadsheets, which can be applied to a wide range of uses, are a good example of an applications program.

ASCII An acronym for American Standard Code for Information Interchange, an 8-bit standard code used in data transmissions applications. The binary number (code) assigned to each alphanumeric character is called ASCII code.

Asynchronous A variable time period between successive bits, characters, or events. In asynchronous data transmission, each character is individually synchronized, usually by using start and stop bits, and is sent at a fixed interval.

Baud A measure of signaling speed which indicates the number of signal events per second. Typically, for voice transmission this is called 1200 baud or 1200 bytes (characters) per second.

Binary search A quick method for a computer search of an ordered sequential file for a particular record. The file is divided into two equal or nearly equal parts and one half is searched. If the record is not located the second half is divided into two or nearly equal parts and one half is searched. This process is repeated until the entire file is searched or the particular record is located.

Bit An abbreviation of the words "binary digit" and as the value of 1 or 0. Usually there are eight bits per character, which permits up to 256 different combinations of ones and zeros to represent the alphabet (upper case and lower case), numbers, punctuation marks and other special characters, and control codes used within a computer. A computer that can process one character at a time is called a 8-bit processor. A computer that processes two characters in parallel is called a 16-bit processor.

Typically, microcomputers are 8-bit or 16-bit processors while larger computers (main frame and mini) are 32-bit processors and can handle four characters simultaneously.

Byte This represents the amount of storage space required to store one character of information such as the letter "A." A kilobyte (KB) is one thousand twenty-four bytes; a megabyte (MB) is one million bytes; a gigabyte (GB) is one billion bytes. Each byte normally contains 8 bits.

Central Processing Unit (CPU) The CPU is that part of a computer that executes the instructions of a program. It performs mathematical functions (addition, subtraction, multiplication, comparisons, and the like) on data.

Data base A complex arrangement of data in which information is organized into files or sets (or set types) containing records that are related in some way. Each set type is defined independently of all other set types. Usually, access pointers which " chain" related files into set types are embedded in the data.

Data base management system A set of computer programs designed to store complex data on a disk and to permit easy retrieval of related data items that share a specified set of characteristics. A data base management system, therefore, minimizes data entry redundancy, ensures data accuracy and integrity, and facilitates easy and efficient retrieval of specified information.

Disk storage This is a set of rigid platters about the size of long playing records inside of an enclosure which are used to store large amounts of data and programs. The rigid base, usually of aluminum, is coated with a thin layer of iron oxide which can be magnetized. Digital information (1's and 0's) is recorded through a write head which generates a high-density magnetic field that in turn alters the magnetic domains in the iron oxide.

EBCDIC An acronym for Extended Binary Coded Decimal Interchange Code, which consists of a character set for 8-bit characters used in data communications where IBM compatible computer equipment is involved.

Electronic mail system A system which allows users to exchange electronically all the information they normally would exchange by conventional mail. An electronic mail system is a computer software package that provides facilities for users to generate, send, read, and file messages. Two or more electronic mail systems may be connected by an electronic mail network. This connection, which is called a gateway, includes a set of systems protocols or rules that interpret the communications requirements of one system for another system, specify how messages are to be transferred, and, among other things, define the format of messages and the action to be taken if a message cannot be delivered.

Emulator A program which permits computer programs written for one computer to be run on another computer. The new computer will act like the old computer in execution of the program.

File A collection of records usually pertaining to one topic.

File server In an integrated office system a file server is a microcomputer that controls the functions relating to network users. In addition, it houses system software and shared application software, coordinates user requests for files, and provides a central storage facility for electronic files. In this sense, a microcomputer file server performs the same functions as a host computer in a distributed system.

Full duplex A data transmission circuit that permits transmission of data in two directions simultaneously.

Half duplex A data transmission circuit that permits transmission of data in two directions, but not at the same time.

Hard-wired A permanent, as opposed to a switched, physical connection between two points in an electrical circuit or between two devices connected by a communications line. When using a microcomputer, local connections (monitor, printer, and CPU) typically are hard-wired while communications through a modem are switched because they use telephone lines.

Hierarchical data base A data base consisting of sets of data files in which each record or file has a master or parent item that appears in no other set of information. For example, consider a data base with demographic data for the United States organized at the national, state, and county levels. The master item is the national item under which are subsumed state level population demographic data. And under each state county level demographic data are subsumed. This could be extended all the way down to family units and individuals. The net result in a tree-like structure in which access to specified information is achieved by following pointers that are embedded at each level.

Large Scale Integration (LSI) The combining of thousands of circuits on a single chip. Typical examples of LSI circuits are memory chips and microprocessors.

Line protocol The procedure for the exchange of two messages between two different points of origin.

Local Area Network A means for connecting terminals, small computers, and office automation systems within a small area, usually a building, so that they can easily exchange information and use common peripherals such as data storage devices and high quality printers. Local Area Networks (LAN) also may be connected to other LANS on larger computers. Generally speaking, there are three basic ways in which LAN computers and peripherals are arranged. The first is a "star" architecture in which there is a central host with radiating spokes to other computers and peripherals. A "ring" architecture in which all of the computers and peripherals are linked in a circle is the second communication models. The third way of LAN communications is based on a "bus architecture" in which computers and peripherals are lineraly linked. In a "star" configuration if the central host malfunctions, the entire network goes down. In a "ring" arrangement, all computers are equally vital and the failure or disconnection of any one interrupts the communication flow around the ring. A "bus" network architecture, in sharp contrast, does not suffer a systems breakdown when one computer malfunctions or is disconnected.

Mainframe A computer that is physically large and provides the capability to perform applications requiring large amounts of data to support a large number of terminals.

Main Memory The area of a computer where there is random access (fastest) to where programs are stored while being executed and relatively small amounts of data are kept while being manipulated. Memory is usually measured in kilobytes (e.g. 16K).

Menu A set of options displayed on a monitor from which a user selects an action to be performed by typing a letter or positioning the cursor.

Menu-driven A computer system that primarily displays menus which are used to give instructions to the computer rather than a series of instructions in a special language.

Microprocessor A single chip central processing unit (CPU) which incorporates LSI technology.

Modem A device or mechanism that converts digital data from a computer or a terminal into analog data for transmission purposes, usually through telephone lines.

Monitor A television-like device that is used to display computer output.

MS-DOS A disk operating system for microcomputers created by MicroSoft. Generally, microcomputers using MS-DOS are considered IBM compatible.

Operating system A set of instructions which manage computer operations, including allocation of computer resources to different activities (e.g. printing).

Optical disk storage A disk typically resembling a long playing record and involves a non-magnetic storage process which achieves very high storage density, on the order of one gigabyte. Optical disk storage systems can be configured to include a juke box arrangement in which as many as 100 disks can be stored and retrieved through mechanical means.

Optical recording A digital bit stream (1's and 0's) are fed into a high speed laser which converts the 1's and 0's into on and off states of power. During an on state the laser records a 1 by physically altering a very small surface of the storage medium.

Packet switching A term used to describe how a fixed number of data bits (or bytes)from a larger quantity of data is uniquely identified as a packet which can be sent over a communication route different from other packets from the larger body of information, and then automatically restored to the proper sequence by the receiving computer. The chief advantages of packet switching are that there are no delays while waiting for a communication channel that will accommodate the larger body of information and that overall communication costs are substantially reduced because all available communication lines are in use.

Parallel transmission Transmission of more than one bit at a time as opposed to serial transmission.

Random access An electronic memory in which a memory location can be addressed directly rather than through a sequence of storage locations.

Read only memory Information (a program usually) permanently etched on a chip and which cannot be used to write or store information.

Relational data base A data base in which all of the data elements are represented in the form of tables which reveal the relationship about data elements. Each table consists of data elements and records which share defined characteristics. A table is called a relation and the power and efficiency of relational data bases are achieved through the manipulation of these tables.

Serial transmission Transmission that sends one bit at a time.

Soft copy Computer output that is displayed on the screen of a monitor or video display unit.

Software A generic term used to describe the instructions or program which a computer performs. Generally, software can be characterized as operating systems, application programs, data base management systems, and application development.

Transfer rate A measure of the amount of time to move a specified amount of data (usually expressed in megabytes per second) from a disk to the memory of a computer.

Winchester disk A hard disk permanently sealed in a drive unit to prevent contaminants from affecting the read/write head. The disk can store larger amounts of data than a diskette.

Window A software feature, usually microcomputer based, which allows users to view several different files on a terminal screen simultaneously. The number of "windows" available depends upon the complexity of the software.

ANNEX 2

END USER HARDWARE/SOFTWARE EVALUATION CRITERIA

END USER HARDWARE/SOFTWARE EVALUATION CRITERIA

Text storage, search, and retrieval systems are database management systems specifically designed to accommodate textual material. Consequently, some of the inherent limitations in data base management systems (record size and pre-identification of retrieval categories) are eliminated. Large volumes of textual material which have been stored and automatically indexed can be searched and retrieved through such techniques as proximity searching, numeric range searching, and Boolean operators.

From an end user perspective, any text storage, search, and retrieval system which meets the following criteria would be acceptable in an archival/records management environment.

Text Entry

The system requires minimal data preparation in creating the stored text.

Knowledge of Computers and Programming Languages

The system requires no programming on the part of a user.

The system is "user-friendly" to the extent that natural language responses are permitted and no prior computer experience or knowledge is presumed.

Document Characteristics

The system has no significant limit on the size of individual records or total number of records, other than those imposed by the computer hardware.

The system can handle both fixed length and variable length text fields.

The system supports retrieval of text material which may be stored in some form of hierarchical relationship.

Machine Requirements

The system can produce an external version of the text material which is compatible with ISO 8211.

The system is not machine-dependent in that it will run in a multiple computer environment.

Search/Retrieval Characteristics

The system permits proximity searches in which the occurrence of two words within a given number of other words can be specified.

The system permits phrase searches in which a search for a specified sequence of words (phrase) can be achieved.

The system has a "wild card" search capability in which words with the same prefix or suffix can be retrieved.

The system permits root word searches in which queries can be specified in terms of a root form as opposed to how the word is actually found in the text.

The user can define "noise" words ("the," "and," "or," and the like) which are automatically excluded from retrieval.

The system permits full text searching as opposed to searching certain fields, such as title or author.

Screen Display

The system automatically highlights in the retrieved text the specified search terms.

The system permits forward and backward scrolling in a document from where a key word or phrase is found.

The system will count the number of times given word appears in a document and will rank documents accordingly in displaying "hits."

Thesaurus

The system has the capacity to support thesaurus construction.

ANNEX 3

QUESTIONNAIRE

GENERAL INFORMATION

1. Name of Person Filling Out Questionnaire __________________

____

2. Organization ____

-

3. Position of Person Filling Out Questionnaire_________________

____

4. Address ____

____

5. Telephone No. ____

TYPE AND SIZE OF ORGANIZATION

6. How many employees does your institution have?

___ 50 or less
___ 51 to 125
___ 126 to 300
___ 301 or more

7. At how many locations does your institution have employees stationed? ________

8. In how many countries does your institution have employees stationed? ________

RECORDS MANAGEMENT RESPONSIBILITIES

9. Are the powers and duties in records management clearly defined and outlined?

___ Yes
___ No

9a. If "yes," for which of the following does this responsibility and duty apply? (Check as many as appropriate)

___ Forms management
___ Directives management
___ Correspondence management
___ Mail management
___ Micrographics
___ Files maintenance
___ Records scheduling
___ Appraisal for archival value
___ Vital records
___ Approval of publications
___ Electronic publishing
___ Reports management
___ Source data automation
___ Clerical work management

10. Do your records management duties and responsibilities clearly include authority over machine-readable or electronic records?

___ Yes
___ No

10a. If "no," who exercises records management responsibility for machine-readable or electronic records?

___ Manager of computer center
___ Financial manager
___ Program officals responsible for content
___ No clearly defined responsibility

11. Are you routinely consulted on records management issues relating to machine-readable or electronic records?

___ Yes
___ No

EXTENT OF AUTOMATION

12. How many large computers (mainframes or minicomputers) does your organization own or lease?

___ none
___ 1
___ 2 or more

13. Does your parent organization obtain mainframe or minicomputer processing services from outside commercial service bureaus?

___ Yes
___ No
___ do not know

14. Please check those activities or functions listed below which are performed on a mainframe or minicomputer in your organization.

___ financial data
___ general housekeeping data (procurement, etc)
___ personnel
___ statistical data bases for reports
___ tracking correspondance
___ controlling forms
___ indexing correspondance
___ space control/location for current records and archives
___ document facsimilie transmission

15. Does the unit with records management responsibilities use large computers (mainframe or minicomputers) in its records management activities?

___ Yes
___ No
___ Do not know

If "yes," please describe the applications:

16. If you answered "yes" to the above question that your institution has or uses large (mainframe or minicomputers), what kind of information is processed? Please check all that apply.

___ Administrative data (e.g. personnel, financial management, inventory of equipment)
____If "administrative data" is checked, please answer Supplemental Questionnaire A.

__ Transactional data (i.e. programmatic case file information)
If "transactional data" is checked, please answer Supplemental Questionnaire B.

___ Indexing applications to textual information

___ Electronic messaging or electronic mail
If "electronic messaging or electronic mail is checked, please answer Supplemental Questionnaire C.

17. How many desk top computers (microprocessors) are used in your organization?

___ do not know
___ none
___ 1 to 10
___ 11 to 35
___ 36 or more

18. Does the unit with records management responsibilities use desk top computers (microprocessors) in its records management activities?

___ Yes
___ No

18.a If "yes," please describe the applications:

19. If you answered "yes" to the above question that your institution has or uses desk top computers (microprocssors), what kinds of applications are used? Ckeck all that apply.

___ Spreadsheet
___ Word processing
___ Data Basa Management Systems
___ Integrated Software
___ Other. Please describe:

20. If you checked "spreadsheet" above, does your institution have any of the following commercial spreadsheet software? Check all that apply.

___ Visicalc or FlashCalc
___ SuperCalc or SuperCalc3
___ PFS:Plan
___ PractiCalc II
___ Dow Jones Spreadsheet Link
___ MagiCalc

20a. If you checked "word processing" above, does your institution have any of the following commcercial word processing software?

___ PFS:Write
___ MultiMate
___ WordStar
___ ThinkTank
___ Microsoft Word
___ Word Perfect
___ Volkswriter Deluxe
___ Word Porcessor Porfessional
___ K-Text
___ Magic Window
___ Other (please specify)

20b. If you checked "data base management" above, does your institution have any of the following commercial data base management systems software?

___ PFS:File
___ dBaseII or dBaseIII
___ Filevision
___ R:base 4000
___ MegaFiler
___ DB Master
___ Data Base Manager II
___ 1stBase
___ Power-Base

20c. If you checked "Integrated software" above, does your institution have any of the following commercial integrated software?

___ Lotus 1-2-3
___ Symphony
___ Framework
___ Electric Desk
___ Smart Software System
___ Open Access
___ Knowledge Manager
___ Magic Office System
___ Aura
___ Decision Manager

21. Do the desk top computers (microprocessors) in your organization "communicate" with other computers either other desk top computers or large computers (mainframes or minicomputers)?

___ Yes
___ No
___ Do not Know

21a. If "yes," do the desk top computers receive data from a centralized data base for analysis by spreadsheet software or data base management system software?

___ Yes
___ No
___ Do not know

21b. Also if "yes," do the desk top computers either receive from or send to other computers draft documents for additional processing?

___ Yes
___ No
___ Do not know

22. For information which desk top computers (microprocessors) process do written guidelines or regulations guide users in determining the disposition of the information?

___ Yes
___ No

22a. If "yes," please attach a copy of the written guidelines or regulations.

23. In the use of desk top computers (microcomputers) in your organization, the greatest gain in productivity has come from which one of the following applications? (Check only one)

___ Word processing for reports and correspondence
___ Electronic mail
___ Project management
___ Electronic teleconferencing
___ Tracking correspondence
___ Compilation of statistics
___ Production of finding aids
___ Other (please specify)

24. In your daily work do you have access to a desk top computer (microcomputer)?

___ Yes
___ No

24a. If you answer "Yes," on the average how much time to you spend each day working at the desk top computer (microcomputer)?

___ less than one (1) hour
___ one (1) to three (3) hours
___ four (4) to five (5) hours
___ six (6) or more hours
___ Not applicable

24b. If you answer "No," to the question of having access to a desk top computer, would you be interested in having such access?

___ Yes
___ No

25. Given your own work situation, which activity would you like to see processed by your own desk top computer (microcomputer)? Please check only one.

___ Word processing for correspondence and reports
___ Electronic mail
___ Project management
___ Electronic teleconferencing
___ Electronic publishing
___ Tracking correspondence
___ Compilation of statistics
___ Production of finding aids
___ Other (please specify)

AUTOMATION OF A CENTRAL REGISTRY

26. Has a central registry been automated in your organization?

___ Yes
___ No. If "no," please do not answer the remaining questions in this section. Please go to the next section - CORRESPONDENCE TRACKING SYSTEMS OR INDEXING SYSTEMS.

26a. If "yes," how many such central registries have been automated in your organization?

___ 1
___ 2 to 4
___ 5 or more

27. What type of computer processes the registry?

___ A large computer (mainframe or minicomputer)
___ A desk top computer or microprocessor
___ Don't know

28. What is the manufacturer and model or series of the computer which processes the central registry? ____

29. What computer software package is used to process the central registry?_______________________________________

30. Who indexes the documents?

___ Indexing staff
___ Records management staff
___ Records creator or records recipient
___ Computer center staff
___ Other. Please specify ______________________________.

31. Does the automated system use the terms in the thesaurus of the manual system or use the file codes of the manual system?

___ Yes
___ No
___ Partially. Please explain:

32. Was the records management staff involved in the design of the system?

___ Yes
___ No
___ Do not know

33. If "yes," what was the extent of the involvement? Check the most appropriate response.

___ The records management staff was presented with the plans for concurrence.

___ The records management staff was consulted during the design of the system and assisted in developing the plans.

___ The records management staff had primary responsibility for designing the system because the system was internal to the records management organization.

___ The records management staff had primary responsibility for designing the system even though the system indexes records in an office outside of the records management section.

34. Is the disposition of the index the same as the records which are indexed?

___ Yes
___ No

35. Who determines the disposition of the index?

___ Records manager
___ Archivist
___ Manager of the computer center
___ Program manager in the office of origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify ________________________________.

36. Who determines the disposition of the records which are indexed?

___ Records manager
___ Archivist
___ Manager of the computer center
___ Program manager in the office origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify ________________________________.

37. Has any of the information in the index been determined to have archival value?

___ Yes
___ No

37a. If "yes," has any of the information been transferred to the archives?

___ Yes
___ No

37b. If "yes," was the transfer in machine-readable or in human-readable form?

___ Machine-readable
___ Human-readable
___ Both machine-readable and human-readable

37c. If the information is scheduled for transfer to the archives, will the information be transferred in machine-readable or human-readable form?

___ Machine-readable
___ Human-readable
___ Has not yet been determined

37d. Who made the decsion about which format in which the information would be transferred to the archives?

___ Archivist
___ Records managers
___ Program officials in the office of origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify __________________________________.
___ No one. It was the only format that the systm could produce which the archives could use.

37e. If the archives has or will receive the information in machine-readable form, will the archives use the same computer center which originally processed the information?

___ Yes
___ No
___ Not yet determined

37f. If "no," have plans been made for the archives to process the machine-readable format?

___ Yes
___ No
___ Not yet determined

CORRESPONDENCE TRACKING SYSTEMS OR INDEXING SYSTEMS

38. Has your institution implemented an automated document tracking system or indexing system other than in a central registry?

___ Yes
___ No. If no, please go to Supplemental Questionnaires A, B, or C as appropriate .

39. If "yes," how many correspondence tracking systems or indexing systems have been implemented in your organization?

____

40. What type of computer processes the tracking system or index?

___ A large computer (mainframe or minicomputer)
___ A desktop computer or microprocessor
___ Don't know

41. What is the manufacturer and model or series of the computer which processes the tracking system or index?

____

42. Who indexes the documents?

___ Indexing staff
___ Records management staff
___ Records creator or records recipient
___ Computer center staff
___ Other. Please specify ______________________________.

43. Was a manual tracking system or indexing system in place prior to the implementation of the automated system?

___ Yes
___ No

44a. If "yes," does the automated system use the terms in the thesaurus of the manual system or use the file codes of the manual system?

___ Yes
___ No
___ Partially. Please explain:

45. Was the records management staff involved with the design of the system?

___ Yes
___ No

45a. If "yes," what was the extent of the involvement? Check the most appropriate response.

___ The records management staff was presented with the plans for concurrence.

___ The records management staff were consulted during the design of the system and assisted in developing the plans.

___ The records management staff had primary responsibility for designing the system because the system was internal to the records management organization.

___ The records management staff had primary responsibility for designing the system even though the system indexes records in an office outside of the records management section.

46. Is the disposition of the index the same as the records which are indexed?

___ Yes
___ No

47. Who determined the disposition of the index?

___ Records manager
___ Archivist
___ Manager of the computer center
___ Program manager in the office of origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify ________________________________.

48. Who determined the disposition of the records which are indexed?

___ Records manager
___ Archivist
___ Manager of the computer center
___ Program manager in the office origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify ________________________________.

49. Has any of the information in the index been determined to have archival value?

___ Yes
___ No
___ Undetermined at this time

50. If "yes," has any of the information been transferred to the archives?

___ Yes
___ No

51. If "yes," was the transfer in machine-readable or in human-readable form?

___ Machine-readable
___ Human-readable
___ Both machine-readable and human-readable

52. If the information is scheduled for transfer to the archives, will the information be transferred in machine-readable or human-readable form?

___ Machine-readable
___ Human-readable
___ Has not yet been determined

53. Who made the decision about which format in which the information would be transferred to the archives?

___ Archivist
___ Records managers
___ Program officials in the office of origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify ________________________________.
___ No one. It was the only format that the system could produce which the archives could use.

54. If the archives has or will receive the information in machine-readable form, will the archives use the same computer center which originally processed the information?

___ Yes
___ No
___ The archives has not and will not receive the information in machine-readable form.

55. If "no," have plans been made for the archives to process the machine-readable format?

___ Yes
___ No

SUPPLEMENTAL QUESTIONNAIRE A

INFORMATION ON LARGE COMPUTERS (MAINFRAME AND MINICOMPUTER)

ADMINISTRATIVE DATA

Please_answer_this_section_if_and_only_if_your_organization processes_administrative_information_on_large_mainframes_and minicomputers.

56. Who determines the disposition of the administrative records in machine-readable form? (check only one)

___ Records manager
___ Archivist
___ Manager of the computer center
___ Program official in the office of origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify ________________________________.

57. If neither the archivist nor records manager determines the disposition, is either the archivist or records manager routinely consulted on disposition questions?

___ Yes
___ No

58. How is administrative data processed? Check all that apply.

___ On-line
___ Batch
___ Data base management systems
___ In-house programs
___ Commercial software

59. Have any records been determined to have archival value?

___ Yes
___ No

60. If "yes," can the information be sent to the archives in a computer format that archives can use?

___ Yes
___ No
___ Don't know

61. Does the archives intend to use or presently use the same computer which originally processed the records?

___ Yes
___ No
___ Don't know

62. Have any records been trasnferred to the archives?

___ Yes
___ No

SUPPLEMENTAL QUESTIONNAIRE B

TRANSACTIONAL DATA

INFORMATION ON LARGE COMPUTERS (MAINFRAMES AND MINICOMPUTERS)

Please_answer_this_section_if_and_only_if_your_organization processes_transactional_data_or_programmatic_case_file_information on_large_mainframes_and_minicomputers.

63. Who determines the disposition of the administrative records in machine-readable form? (check only one)

___ Records manager
___ Archivist
___ Manager of the computer center
___ Program official in the office of origin
___ Chief financial officer
___ Legal counsel
___ Other. Please specify ________________________________.

64. If neither the archivist nor records manager determines the disposition, is either the archivist or records manager routinely consulted on disposition questions?

___ Yes
___ No

65. How is transactional data processed? Check all that apply.

___ On-line
___ Batch
___ Data base management systems
___ In-house programs
___ Commercial software

66. Have any transactional data records been determined to have archival value?

___ Yes
___ No

67. If "yes," can transactional data be sent to the archives in a format that the archives can use?

___ Yes
___ No
___ Don't know

68. Does the archives intend to use or presently use the same computer which originally processed the transctional data?

___ Yes
___ No
___ Don't know

69. Have any transactional data records been trasnferred to the archives?

___ Yes
___ No

SUPPLEMENTAL QUESTIONNAIRE C

ELECTRONIC MESSAGING SYSTEMS OR ELECTRONIC MAIL SYSTEMS

Please_answer_this_section_if_and_only_if_your_organization uses_electronic_messaging_systems_or_electronic_mail_systems.

70. How long has your organization been using electronic messaging systems or electronic mail systems?

___ less than one year
___ one to two years
___ two or more years

71. Is the host computer for the main electronic messaging system owned and operated by your organization?

___ Yes
___ No. The electronic messaging system is external to the organization.

72. How many of the organizations employees have access to the electronic messaging system?

___ fifteen or less
___ sixteen to fifty
___ fifty-six or more
___ Do not know

73. In how many locations do employees have access to the electronic messaging system? ________

74. Do people outside of the organization communicate with the organization through electronic messaging systems?

___ Yes
___ No
___ Do not know

75. If "yes," how many actually communicate to the organization through the electronic messaging system?

___ fifteen or less
___ sixteen to fifty
___ fifty-six or more
___ Do not know

76. Is the disposition policy that has been determined for the human-readable documents the same for similar documents in machine-readable form in the electronic messaging system?

___ Yes
___ No
___ The disposition is not yet determined for machine-readable information.

77. Who made or will make the decision regarding the disposition of documents stored electronically?

___ Archivist
___ Records manager
___ Manager of the computer center
___ Program official in the office of origin
___ Chief financial officer
___ Legal Counsel
___ Other. Please specify ________________________________.

78. If it is neither the archivist or the records manager, is either the archivist or the records manager routinely consulted about the disposition of electronically stored information?

___ Yes
___ No

79. If the disposition policy has been determined, who applies it to individual electronic stored documents?

___ Document creator
___ Document recipient
___ Records manager
___ Archivist
___ Computer center staff
___ Other. Please specify ________________________________.
___ The disposition policy has not been determined.

80. When is the disposition for an incoming individual electronically stored document determined? (check only one)

___ At the time the document is received and read.
___ When the records management unit reviews it.
___ When the computer center periodically runs a program to erase certain types of documents or to retain certain types of documents.
___ The system automatically erases all documents after a certain age.
___ When the records are no longer current.

81. Have any of the electronically stored documents been determined to have archival value?

___ Yes
___ No

82. If "yes," have any of the documents been transferred to the archives?

___ Yes
___ No

83. If "yes," was the information transferred in machine-readable or human-readable form?

___ Machine-readable
___ Human-readable
___ Both

84. If the information is scheduled for transfer to archival custody, will the information be transferred in machine-readable or human-readable form?

___ Machine-readable form
___ Human-readable form
___ Both

85. Who made the decision about the format for transferring the information to the archives?

___ Archivist
___ Records manager
___ Program official in the office of origin
___ Manager of the computer center
___ Other. Please specify ______________________________
___ No one. It is the only format that the system can produce records which the archives can process.

86. If the archives has or will receive the information in machine-readable format, will the archives use the same computer which originally porcessed the electronic messages?

___ Yes
___ No

THANK YOU

Please mail the questionnaire to Charles M.Dollar, National Archives and Records Administration, 9th and Pennsylvania Ave., N.W., Washington, DC USA

ANNEX 4

SOURCES

SELECTED READINGS AND SOURCES

ACCIS Newsletter. Geneva: Advisory Co@mittee for the Coordination of Information Systems, 1983 - (ISSN 0254-3133)

U. Beyschlag, "COMICS Final Report." Geneva: CERN, 1985. 50 pp. (CERN/DD/COMICS - PPR/R4)

Jean Carroll, "The End-User Approach to Managing Information," Records Management Quarterly, 15, 4 (1981): pp. 14-24, 32.

Stephen Connell and Ian A. Galbraith, Electronic Mail: A Revolution in Business Communications. White Plains, N.Y. Knowledge Industry Publication, 1982. 141 pp.

Bruce D'Ambrosio, "Building Expert Systems with M.1," Byte (June 1985), pp. 371-375.

Mary Karon Dash, "A Close-Up of Two Implementation Strategies," Computerworld Focus, 19, 41A (October 16, 1985), pp. 39-40.

Charles H. Davis and James E. Rush, Guide to Information Science Westport: Greenwood Press, 1979. 305 pp.

Charles M. Dollar, "Appraising Machine-Readable Records," American Archivist, 41, 4 (1978), pp. 423-430.

W. Theodore Durr, "Some Thoughts and Designs about Archives and Automation, 1984," American Archivist, 47, 3 (1984), pp. 277-289.

David Fain and Garrett Gruener, "CAR: The Digital Approach," Information and Records Management, 13, 5 (1979), pp. 21-22.

Sidney B. Geller, Computer Science and Technology: Care and Handling of Computer Storage Media. Washington, DC: National Bureau of Standards, 1983. 132 pp. (NBS SP500-101)

Jose-Marie Griffiths, *Application of Minicomputers and Micro-comouters to Information Handling*. Paris: UNESCO, 1981. 94 pp. (PGI-81/WS/28)

Margaret Hedstrom, *Archives and Manuscripts: Machine-Readable Records*. Chicago: Society of American Archivists, 1984. 75 pp.

Inter-Organization Board for Information Systems. Planning for the Implementation of New Information Systems Within the Organizations of the United Nations. Geneva: United Nations, 1981. 44 pp.

Richard M. Kesner, *Automation for Archivists and Records Managers: Planning and Implementation Strategies.* Chicago: American Library Association, 1984. 222 pp.

, "Microcomputer Archives and Records Management Systems: Guidelines for Future Development," *American Archivist*, 45, 3 (1982), pp. 299-311.

, *Information Management: Machine-Readable Records, and Administration: An Annotated Bibliography*. Chicago: The Society of American Archivists, 1983. 153 pp.

Paul Kinnucan, "Software Tools Speed Expert Systems Development," *High Technology* (March, 1985), pp.16-25,

Eric J. Lerner, "Parallel Processing Gets Down to Business," *High Technology* (July, 1985), pp. 20-28.

John McDonald, Mark Hopkins, and Jacques Malette, *Interim Report of the Public Archives of Canada/Department of Communications Information Management Working Group*. Ottawa: Public Archives of Canada, 1984. 60 pp. plus appendices.

Robert M. Mason, "Current and Future Microcomputer Capabilities: Selecting the Hardware," *Microcomputers for Information Management*, 1 (1984), pp. 1-13.

John S. Mayo, "The Evolution of Information Technologies," in *Information Technologies and Social Transformation*. Washington: National Academy of Engineering, 1985. 171 pp.

NARA Bulletin No. 85-2. *Electronic Record Keeping*. (June 18, 1985) National Archives and Records Administration, Washington, DC. 4 pp.

Harold Naugler, *The Appraisal of Machine-Readable Records: A RAMP Study with Guidelines*. Paris: Unesco, 1984. (PGI-84/WS27) 101 pp., plus appendices.

Ralph G. Peck, "Digital Imaging Technology at the Federal Energy Regulatory Commission," 48, *Journal of Micrographics* (March 1983), pp. 48-56.

Joseph Price, "The Optical Disk Pilot Program at the Library of Congress," *Videodisc and Optical Disk*, 4, 6 (November-December 1984), pp. 424-432.

James B. Rhoads, *The Role of Archies and Records Management in National Information Systems: A RAMP Study*. Paris: UNESCO, 1983. (PGI-83/WS21) 56 pp.

David L. Shay, "You Can Justify Office Automation: A Methodology," *Computerworld Focus*, 19, 41A (October 16, 1985), pp. 31-36.

Earl D.Sohm, *The Changing Use of Computers in Organization of the United Nations System in Geneva: Management Issues, Joint Inspection Unit*. Geneva: United Nations, 1985. 40 pp.

David J. Stang, "Future Appears Bright for Micros," Government *Computer News*, (June 7, 1985), pp. 25, 66-72.

William J. Synnott and William H. Grube, *Information Resource Management: Opportunities and Strategies for the 1980s*. New York: John Wiley, 1981. 356 pp.

Technology Assessment Report: Speech Pattern Recognition, Optical Character Recognition, Digital Raster Scanning. Washington, DC: National Archives and Records Service, 1984. 139 pp.

John Williamson and Bob Ragett, *Teletex, Eurodata Foundation Guides for Managers*. London: Eurodata Foundation, 1982, 69 pp.

RAMP and Related Documents

1. Unesco. General Information Programme. Expert Consultation on the Development of a Records and Archives Management Programme (RAMP) Within the Framework of the General Information Programme, 14-16 May 1979. Paris, *Working Document* (PGI/79/WS/1). Paris, Unesco, 1979. 19 p. Available also in French.

2. Unesco. General Information Programme. Expert Consultation on the Development of a Records and Archives Management Programme (RAMP) Within the Framework of the General Information Programme, 14-16 May 1979. Paris, *Final Report* (PGI/79/WS/II). Paris, Unesco, 1979. 36 p. Available also in French.

3. Manning, Raymond, Gilberte Pérotin and Sven Welander, comps, and eds. *Guide to the Archives of International Organizations*. Part I. The United Nations System. Preliminary version (PGI/79/WS/7). Paris, 1979. 301 p.

4. Cook, Michael. *The Education and Training of Archivists -- Status Report of Archival Training Programmes and Assessment of Manpower Needs* (PGI/79/CONF. 604/COL.2). Paris, Unesco, 1979. 71 p. Available also in French

5. Delmas, Bruno. The Training of Archivists -- Analysis of the Study Programme of Different Countries and Thoughts on the Possibilities of Harmonization (PGI/79/CONF. 604/COL.1). Paris, Unesco, 1979. 75 p. Available also in French.

6. Unesco. Division of the General Information Programme. Meeting of Experts on the Harmonization of Archival Training Programmes, 26-30 November, Paris, 1979. *Final Report* (PGI/79/CONF. 604/COL.7). Paris, Unesco, 1980. 18 p. Available also in French.

7. Roper, Michael. *Democratic Republic of the Sudan: Establishment of a Technical Training Centre in Archival Restoration and Reprography* (FMR/PGI/80/180). Paris, Unesco, 1980. 31 p.

8. Kecskeméti, Charles and Evert Van Laar. *Model Bilateral and Multilateral Agreements and Conventions Concerning the Transfer of Archives* (PGI/81/WS/3) Paris, Unesco, 1981. 34 p. Available also in Arabic, French, Russian and Spanish.

9. Silva, G.P.S.H. de. *A Survey of Archives and Manuscripts Relating to Sri Lanka and Located in Major London Repositories* (PGI/81/WS/4). Paris, Unesco, 1981 100 p.

10. Borsá, Iván. *Feasibility Study on the Creation of an Internationally Financed and Managed Microfilm Assistance Fund to Facilitate the Solution of Problems involved in the International Transfer of Archives and in Obtaining Access to Sources of National History Located in Foreign Archives* (PGI/81/WS/7). Paris, Unesco, 1981. 31 p. Available also in Arabic, French, Russian and Spanish.

11. White, Brenda. *Archives Journals: A Study of their Coverage by Primary and Secondary Sources.* (RAMP Studies and Guidelines). (PGI/81/WS/10. Paris, Unesco, 1981. 72 p. Available also in French

12. Pieyns, Jean. *Feasibility Study of a Data Base on National Historical Sources in Foreign Repositories* (PGI/81/WS/24). Paris, Unesco, 1981. 66 p. Available also in French.

13. Weill, Georges. *The Admissibility of Microforms as Evidence: A RAMP Study* (PGI/81/WS/25). Paris, Unesco, 1982. 84 p. Available also in French and Spanish.

14. Hull, Felix. *The Use of Sampling Techniques in the Retention of Records: A RAMP Study with Guidelines* (PGI/81/WS/26). Paris, Unesco, 1981. 64 p. Available also in French and Spanish.

15. Cortés Alonso, Vicenta. *Perú: Sistema Nacional de Archivos y Gestión de Documentos: RAMP Proyecto Piloto* (FM/PGI/81/110). Paris, Unesco, 1981. 56 p.

16. Crespo, Carmen. *Republic of Argentina: Development of a Regional Demonstration and Training Centre at the School for Archivists, University of Cordoba* (FMR/PGI/81/116 E). Paris, Unesco, 1981. 28 p. Available also in Spanish.

17. Ricks, Artel. *Republic of the Philippines: RAMP pilot project for the establishment of a regional archives and records centre*. (FMR/PGI/81/158). Paris, Unesco, 1981. 49 p.

18. Evans, Frank B. *The Republic of Cyprus: Development of an archival and records management programme* (FMR/PGI/81/166). Paris, Unescom 1981. 64 p.

19. Unesco. General Information Programme. *Survey of Archival and Records Management Systems and Services 1982* (PGI/82/WS/3). Paris, Unesco, 1982. Available also in French.

20. Rhoads, James B. *The Applicability of UNISIST Guidelines and ISO International Standards to Archives Administration and Records Management: A RAMP Study* (PGI/82/WS/4). Paris, Unesco, 1982. 95 p. Available also in French and Spanish.

21. Unesco. Division of the General Information Programme. Second Expert Consultation on RAMP (RAMP II) Berlin (West), 9-11 June 1982. *Working Document* (PGI/82/WS/6). Paris, Unesco, 1982. 31 p.

22. White, Brenda. *Directory of Audio-Visual Materials for Use in Records Management and Archives Administration Training* (PGI/82/WS/8). Paris, Unesco, 1982. 71 p.

23. Tirmizi, S.A.I. *Guide to Records Relating to Science and Technology in the National Archives of India: A RAMP Study* (PGI/82/WS/12). Paris, Unesco, 1982. 84 p.

24. Cook, Michael. *Guidelines for Curriculum Development in Records Management and the Administrations of Modern Archives: A RAMP Study* (PGI/82/WS/16). Paris, Unesco, 1982. 74 p.

25. Unesco. Division of the General Information Programme. Second Expert Consultation on RAMP (RAMP II) Berlin (West), 9-11 June 1982. *Final Report* (PGI/82/WS/24). Paris, Unesco, 1982. 54 p. Available also in French and Spanish

26. Evans, Frank B. *Malaysia: Development of the Archives and Records Management Programme* (FMR/PGI/82/110). Paris, Unesco, 1982. 54 p.

27. Ricks, Artel. *Philippines: RAMP Pilot Project for the Establishment of a Regional Archives and Records Centre (Report No.2)* (FMR/PGI/82/161). Paris, Unesco, 1982. 24 p.

28. Evans, Frank B. Writings on archives published by and with the assistance of Unesco: A RAMP Study (PGI-83/WS/5). Paris, Unesco, 1983. 33 p.

29. Evans, Frank B. and Eric Ketelaar. *A Guide for Surveying Archival and Records Management Systems and Services: A RAMP Study* (PGI-83/WS/6). Paris, Unesco, 1983. 30 p. Available also in French and Spanish.

30. Hildesheimer, Françoise. *Guidelines for the Preparation of General Guides to National Archives: A RAMP Study* (PGI-83/WS/9). Paris, Unesco, 1983. 67 p. Available also in French.

31. Kula, Sam. *The Archival Appraisal of Moving Images: A RAMP Study with Guidelines* (PGI-83/WS/18). Paris, Unesco, 1983. 130 p.

32. Moideen, P.S.M. *A Survey of Archives Relating to India and Located in Major Repositories in France and Great Britain* (PGI-83/WS/19). Paris, Unesco, 1983. 72 p.

33. Duchein, Michel. *Obstacles to the Access, Use and Transfer of Information from Archives: A RAMP Study* (PGI-83/WS/20). Paris, Unesco, 1983. 80 p. Available also in French.

34. Rhoads, James B. *The Role of Archives and Records Management in National Information Systems: A RAMP Study* (PGI-83/WS/21). Paris, Unesco, 1983. 56 p. Available also in French.

35. Hendriks, Klaus B. *The Preservation and Restoration of Photographic Materials in Archives and Libraries: A RAMP Study with Guidelines* (PGI-84/WS/1). Paris, Unesco, 1984. 121 p.

36. Stark, Marie C. *Development of Records Management and Archives Services within United Nations Agencies* (PGI-83/WS/26). Paris, Unesco, 1983. 215 p.

37. Kathpalia, Y.P. *A Model Curriculum for the Training of Specialists in Document Preservation and Restoration: A RAMP Study with Guidelines* (PGI-84/WS/2). Paris, Unesco, 1984. 27 p. Available also in French and Spanish.

38. Seton, Rosemary E. *The Preservation and Administration of Private Archives: A RAMP Study* (PGI-84/WS/6). Paris, Unesco, 1984. 65 p. Also available in French and Spanish.

39. Taylor, Hugh A. *Archival services and the concept of the user: a RAMP Study* (PGI-84/WS/5). Paris, Unesco, 1984. 98 p. Also available in French and Spanish.

40. Charman, Derek. *Records surveys and schedules: A RAMP Study with Guidelines*. (PGI-84/WS/26). Paris, Unesco, 1984. 112 p.

41. Crespo, Carmen and Vicente Vinas. *La Preservación y restauración de documentos y libros en papel: un estudio del RAMP con directrices.* (PGI-84/WS/25). Paris, Unesco, 1984. 109 p.
English version in preparation.

42. Jubb, Michael. *Guide to records relating to science and technology in the British Public Record Office: A RAMP Study.* (PGI-84/WS/9). 313 p.

43. Keene, James A. and Michael Roper. *Planning, equipping and staffing a document reprographic service: A RAMP Study with Guidelines.* (PGI-84/WS/8). Paris, Unesco, 1984. 97 p.
Also available in Spanish.

44. Naugler, Harold. *The Archival appraisal of machine-readable records: A RAMP Study with Guidelines.* (PGI-84/WS/27). Paris, Unesco, 1984. 161 p.

45. Wimalaratne, K.D.G. *Scientific and technological information in transactional files in government records and archives: A RAMP Study.* (PGI-84/WS/7). Paris, Unesco, 1984. 70 p.
Also available in French and Spanish.

46. Guptil, Marilla B. *Archival appraisal of records of international organizations: A RAMP Study with Guidelines.* (PGI-85/WS/4). Paris, Unesco, 1985. 96 p.

47. Ketelaar, Eric. *Archival and records management legislation and regulations: A RAMP Study with Guidelines.* (PGI-85/WS/9). Paris, Unesco, 1985. 121 p

48. Orléans, Jacques d'. *The Status of archivists in relation to other information professionals in the public service in Africa: A RAMP Study.* (PGI-85/WS/2). Paris, Unesco, 1985. 43 p.

49. Van Laar, Evert. *The Status of archives and records management systems and services in African Member States: A RAMP Study.* (PGI-85/WS/3). 78 p.

50. Leary, William H. The Archival appraisal of photographs : a RAMP study with guidelines. (PGI–85/WS/10). Paris, Unesco, Paris, Unesco, 1985, 121 p.

51. Fishbein, M.H. *A Model curriculum for the education and training of archivists in automation: a RAMP study* (PGI-85/WS/27). 31 p.

52. Tanodi, Aurelio. *La Situacion (status) de archiveros en relacion con otros profesionales de informacion en la administracion publica de America latina*: un estudio RAMP (PGI-85/WS/13). 74 p.

53. Walne, Peter. *Guide to the archives of international organizations.* Part II.(PGI-85/WS/18). 131 p.

54. Mabbs, A.W. *Guide to the archives of international organizations.* Part III. (PGI-85/WS/19).40 p.

55. Walne, Peter. *Modern archives administration and records management: a RAMP reader* (PGI-85/WS/32). 587 p.

Copies of the above studies and reports may be obtained without charge, to the extent that they are still in print, by writing to:

Division of the General Information Programme
Documentation Centre
UNESCO
7, Place de Fontenoy
75700 Paris
France